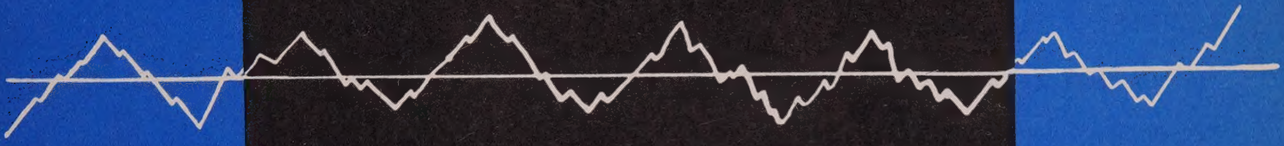
cycles



—A MONTHLY REPORT

January 1954

FOUNDATION FOR THE STUDY OF CYCLES
New York, New York

CONTENTS

Page

THE DIRECTOR'S LETTER 3

RESEARCH
CYCLES IN MANUFACTURING PRODUCTION (continued)
The Basic Structure 5

THE 8-YEAR AND 6-YEAR CYCLES IN GOODYEAR TIRE AND RUBBER COMPANY SALES 8

HOW IT CAME OUT
The 6-Year Cycle in Pittsburgh Plate Glass Company Sales . . 13

LETTERS 17

FOUNDATION AFFAIRS 20

QUESTIONS AND ANSWERS 22

ADDITIONS TO THE LIBRARY 24

SUPPLEMENT
Chapter VII, from *Cycles, The Science of Prediction*, a book by Edward R. Dewey and E. F. Dakin, and the 1954 Postscript 25

THE FOUNDATION FOR THE STUDY OF CYCLES

The Committee of the Foundation consists of the following scientists and administrators:

UNITED STATES OF AMERICA

Copley Amory, Chairman Emeritus

Charles Greeley Abbot
Research Associate
Smithsonian Institution

Harold Elmer Anthony
Chairman and Curator
Department of Mammals
American Museum of Natural History

George Baekeland, Chairman of the
Committee of the Foundation
The Bakelite Corporation

Harold Gardiner Bowen
Vice Admiral, U.S. Navy, Retired
Executive Director, Thomas Alva
Edison Foundation

Verne Burnett
Partner
Verne Burnett Associates

Hon. W. Cameron Forbes
Member, Board of Trustees
Carnegie Institution of Washington
Life Member of the Corporation
Massachusetts Institute of Technology

Webster N. Jones
Vice Presedent
Carnegie Institute of Technology

Daniel Trembly MacDougal
Former Director
Department of Botanical Research and
Laboratory of Plant Physiology
Carnegie Institution of Washington

John Quincy Stewart
Professor of Astronomical Physics
Princeton University

CANADA

Hon. Charles Camsell
Former Commissioner
Northwest Territories

Frank Cyril James
Principal and Vice-Chancellor
McGill University

GREAT BRITAIN

Sir Patrick Ashley Cooper
Governor
Hudson's Bay Company

Julian Sorell Huxley
Former Director General
United Nations Educational, Scientific and Cultural Organizations

Edward R. Dewey, Director

CYCLES—A MONTHLY REPORT IS PUBLISHED BY THE FOUNDATION FOR THE STUDY OF CYCLES EVERY MONTH EXCEPT DURING JULY AND AUGUST AT THE FOUNDATION'S OFFICE AT EAST BRADY, PENNSYLVANIA. SUBSCRIPTION RATES $10.00 A YEAR. RE-ENTRY APPLIED FOR AS SECOND CLASS MATTER AT THE POST OFFICE AT EAST BRADY, PENNSYLVANIA. MEMBERSHIP OFFICE, 9 EAST 77TH STREET, NEW YORK 21, NEW YORK.

COPYRIGHT 1954

cycles
-a monthly report

VOLUME V NUMBER 1 JANUARY 1954

The official Bulletin of
the Foundation for the
Study of Cycles

The Director's Letter

Dear Member:

The coming depression will be a minor one, as best I am able to say at the present time. I look forward to no *major* depression until the late 1960's or 1970's.

By depression I mean curtailment of pyysical production of manufactures in the United States.

The forecast made above runs counter to prevailing belief. In this respect it is in the same class with the forecast I made during World War II that there would be no "first" post-war depression—no 1921. That forecast was fulfilled. I hope that this one will be too.

I have not always been right. In 1943 and 1944 when the book *Cycles—The Science of Prediction* was written, and even as late as 1949, I thought that we would have a depression in the early 1950's. Several important cycles were due for a low at that time. However, as I learned more about cycles and discovered other cycles which would be going up then, I came to feel, and told you repeatedly, that the 1951-52 depression would be mild.

Of course, in part due to the Korean War, there was *no* 1951-52 depression. But even if there had been no Korean War and —more important--no preparation for World War III, I doubt if the '51-'52 setback would have been of more than slight proportions. The Korean War provides me with a wonderful alibi, but I do not choose to use it.

A post-mortem may be in order, not by way of excuse, for there is no excuse when one is wrong, but to help prevent making the same sort of mistake again.

I was wrong about a 1951-52 depression for two reasons. First I took for granted that the half-century cycle in *production,* which I had not yet had an opportunity to study, had its tops and bottoms at about the same time as the 54-year cycle in *prices*, which I had studied (we now know that it does not).

Second, my knowledge of cycles was inadequate. It was not bad as far as it went, but it did not go far enough.

Applying this post-mortem to the present forecast, the first source of error no longer applies, for the forecast expressed above that the coming depression will be a minor one is based solely upon a study of cycles in physical production of manufactures in the United States (and it applies exclusively to those figures).

On the other hand, the second source of error still exists. No one in the world yet has an adequate knowledge of cycles. But if you only knew how much better even an inadequate knowledge of cycles is to the usual cause and effect reasoning by prophets of finite minds and long tongues who know neither cause nor effect! Most such prophets do not even know that they do not know—or at least they dare not admit it!

Now, speaking of error, be sure that *you* do not make the same error I made by assuming, because a cycle or group of cycles is present in one series of figures, such as physical production of manufactures, that it is present in some other series of figures too. Do not transfer the forecast of probable future behavior made above to farm production, mineral production, building construction, real estate activity, commodity prices, stock prices, or even to the physical output of particular industries. *Every single series of figures has to be forecast separately.*

In closing this section of this letter there is one additional point I wish to stress:

It is important that you realize that the forecast given above is probably the only forecast you have seen or will see which is independent of the thinking of any other human being whatsoever. I will go further and say it is independent of even my own "thinking". It is purely mechanistic. The only judgement that went into it had to do with evaluating the significance of the cycles. (The cycles *have* been present for a hundred years or more. Judgement is involved only in estimating —from their symmetry, their regularity, and the presence of similar cycles in other longer series of figures—whether or not they were present merely by accident.) Actually, I was surprised at the way the synthesis of the various cycles came out.

The other forecasts you read are made by people awash with each other's ideas. Black says something in a tentative sort of way. *Because* Black says it, and because it sounds as if it might be so, White picks it up and elaborates upon it. So does Gray. And Brown. Black reads White, Gray, and Brown, and *because they say it,* he accepts the idea wholeheartedly. Black now becomes more positive. Have not White, Gray, and Brown said it was so? White, Gray, and Brown now become more positive too. Did not Black say so, again, and more forthrightly? I have been in whirligigs of this sort myself and have believed things I saw in print which, upon investigation, proved to be merely some of my own half baked conjectures dressed in fancy clothes. It is only mechanistic forecasts, such as those based purely on cycles, which are truly independent.

More Detailed Forecast to Come

And now you want a more detailed forecast. Just when will the depression start? Just when will it end? How deep will it be? Just what is ahead for 1954?

I do not know. I have been studying cycles in manufacturing production for only about three months. (It takes *at least* a year to make a cycle analysis of a series of figures.) So far I have investigated cycles over 9 years in length only. There are many shorter cycles. It is they which we must know about if we want to pin point, as far as a knowledge of cycles will let us, the exact characteristics of the forthcoming decline.

Of course I do know that in many lines of business there is an important 6-year cycle. Typically it crests in 1953, 1954, or 1955, depending upon the business. I also know that the crests of this 6-year cycle, like the crests of all other cycles, sometimes come a fraction of a cycle early or a fraction of a cycle late. However, I do not yet know the extent to which the 6-year cycle governs manufacturing production as a whole.

Some businesses fluctuate in an 8-year cycle. Others are dominated by cycles of other lengths. Each according to its kind. I expect we will find traces of all these cycles in manufacturing production as a whole, but let us not jump the gun.

Cordially yours,

Edward R. Dewey

Director

CYCLES IN MANUFACTURING PRODUCTION —continued

The Basic Structure

THE basic underlying structure of manufacturing production in the United States has been tentatively determined. If it has been determined correctly, and if it continues, it will cause a long downhill influence for 20 years or so, and then another burst of productivity for twenty years or so to follow.

What is this basic structure? How much reliance can we place upon its determination and its continuation? How will it be modified by other factors?

Let me take up these three points in order.

One, the basic structure of the growth of manufacturing production in the United States can be described in terms of three elements: one, a smooth underlying growth trend which increases at a constantly decreasing rate; two, a repetitive cycle about half a century long, and three, a repetitive cycle something over a third of a century long.

Two, the clarity with which each of these three elements remains when we adjust for the other two, and the extent to which the known behavior is described by the three elements in combination makes me, for one, believe that we have here something more than description. I believe that in these elements we have a clue to causative factors which can be counted on to continue. I believe these factors will create the framework within which manufacturing production will operate, indefinitely into the future. But remember, these are but one man's opinions.

I shall give you, in detail, in future articles, the basis for my opinions so that you will be in a position to agree with me, or disagree, as you see fit.

Three, the framework described above allows plenty of room for booms and depressions counter to the general trend. Shorter cycles and accidental factors will register their impact importantly. And of course the next war will have terrific impact. If we are thoroughly bombed, production will take a nose dive. If we escape bombing, production will soar.

The concept of a gradual downward influence is not immediately alarming. In fact, the two major cycles named above are both *above* trend for the next ten years. During this period booms should be magnified, depressions minimized. It is during the twenty years which follow (1865—1885) that this pattern, if it persists, will contribute toward a major depression.

Fig. 1 on the next two pages diagrams the one-half century cycle, the one-third century cycle, their combinations, and the trend. I have also wrapped the synthesis of the two cycles around the trend so that you can see the combination of all three elements.

I do not yet know the *exact* length, timing, or strength of either of the two major underlying cycles or the *exact* characteristics of the trend. As nearly as I can tell at the moment, however, the one-third century cycle is slightly the more important of the two cycles. It has a crest *about* 1955, runs from *about* 121% of trend at crest to *about* 83% of trend at trough, and is *about* 36 years long.

When this and some of the other cycles have been adjusted for, the dominant half

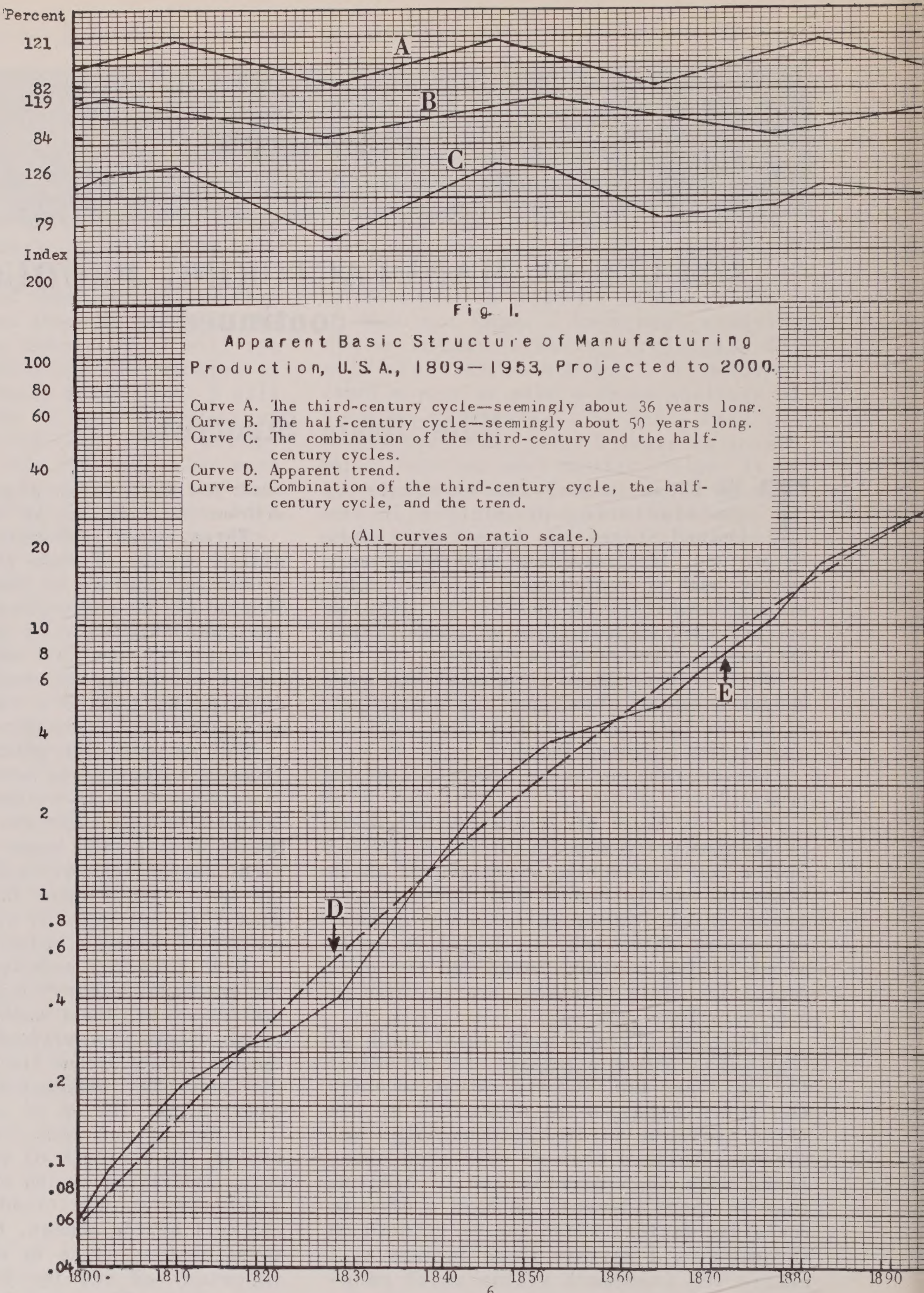
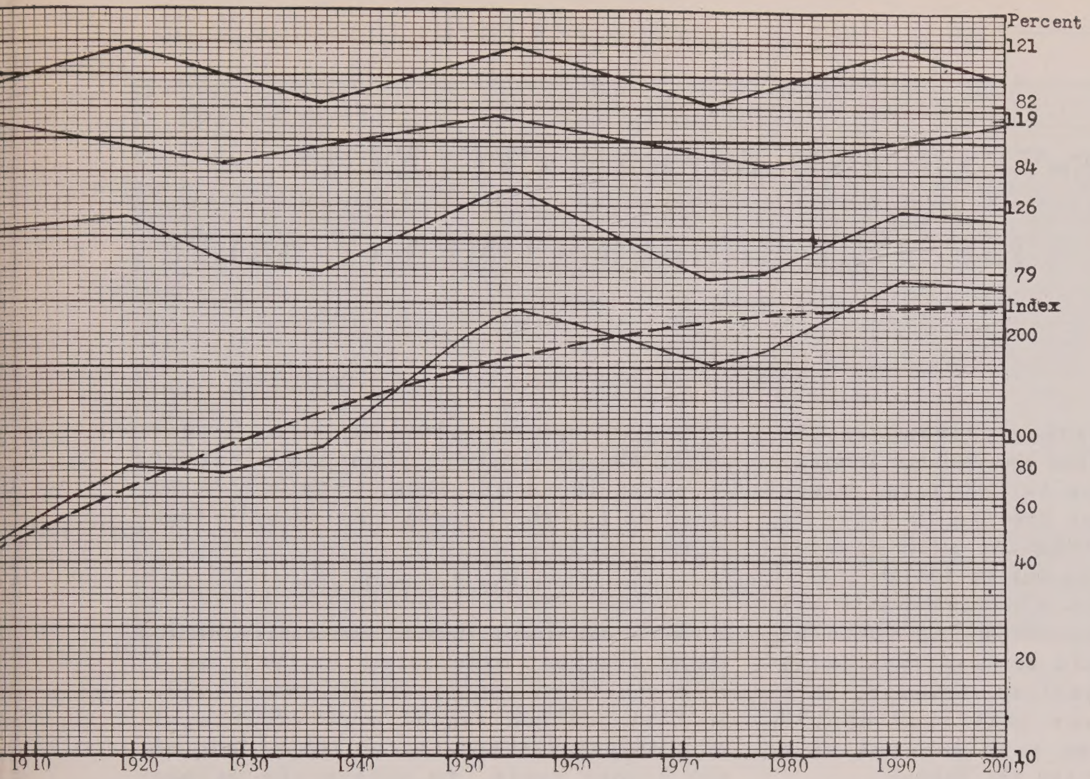


Fig. 1.

Apparent Basic Structure of Manufacturing Production, U.S.A., 1809—1953, Projected to 2000.

Curve A. The third-century cycle—seemingly about 36 years long.
Curve B. The half-century cycle—seemingly about 50 years long.
Curve C. The combination of the third-century and the half-century cycles.
Curve D. Apparent trend.
Curve E. Combination of the third-century cycle, the half-century cycle, and the trend.

(All curves on ratio scale.)



century cycle turns out to be *about* 50 years long, not 54 years long, as had been generally thought, and as I have been forced to assume until now.

As nearly as I can measure it at the present time, this 50-year cycle crests *about* 1955, runs from *about* 119% of trend at crest to *about* 84% of trend at trough.

I do not yet know if the minor 54-year cycle discussed in my report for November 1953 is also present in addition to the much stronger 49- or 50-year cycle of which I am speaking here, or is an artifact created by the assumption that the half century cycle was indeed of the same length as the 54-year cycle which had been present for more than 800 years in British wheat prices. This subject will be investigated further at a later date.

Underlying growth trend, as tentatively determined, increased at the rate of 23% for the ten year period just ended. During the next decade the rate of growth will be 18%. Growth will continue similarly, less each decade, until maturity at about 2000, or a little later, if trend has been determined correctly.

Now, in closing, let me revert to the matter of reliability.

The picture of the future, drawn by the projection of these two major cycles and the trend, runs counter to all present day thinking. If it is correct it is therefore important.

The crux of the matter is, have I been merely ingenious in postulating two cycles and a trend which in combination *describe* what has happened, or have I unscrambled, from the welter of ups and downs of the past century and a half, reflections of three basic elements of a continuing nature which have *caused* what has happened?

Only the future can give the answer for sure, but in the meantime you must either accept or reject my projection. If you accept it, and if I am wrong, it will be bad. On the other hand, if you reject it, and if I am right, that will be bad, too.

I ask you to suspend judgement in regard to this matter of reliability until I have had a chance (in the next report or two) to present to you the evidence upon which I have come to my conclusions.

After presenting the evidence for the half-century and third-century cycles and the trend (and refining the tentative values given above) I shall tell you more about the shorter cycles, so as to throw as much light as possible upon the timing, depth, and duration of the next *major* depression and also upon the business outlook for the immediate future.

E.R.D.

THE 8-YEAR AND 6-YEAR CYCLES IN GOODYEAR TIRE AND RUBBER COMPANY SALES

Summary: If the cycles present in the sales of Goodyear Tire and Rubber Company since 1926 continue to dominate, there will be an important decline in sales to end, ideally, in 1956. An even greater percentage recovery is due to follow.

Twenty-six years of records are not very much to go on. If we had twice as many figures we could be more than twice as sure of the projection. However, both cycles are so clear that they should definitely be taken into account as a distinct possibility for the future.

FROM 1926, the earliest figures available to me, through 1952, the net sales of the Goodyear Tire and Rubber Company have been characterized by an 8-year cycle of considerable importance. During this period of time there has been opportunity for only three repetitions of this cycle. This is very little to go on. However, the fact that crests of the eight year pattern in Goodyear come at the same time as crests in the 8-year cycle in other series where we have many repetitions of the cycle, adds credibility to the concept of an 8-year cycle in these figures.

Goodyear sales are plotted in Fig. 1. On the same chart I have shown, by means of a broken line, a 7-year moving average trend.

The 8-Year Cycle

To show you the 8-year cycle better, I have also charted the data as percentages of their 7-year moving average trend, as in Fig. 2. As such a trend looses three years at each end of the series, the curve in Fig. 2 runs only from 1929 through 1949.

The 8-year cycle is diagramed by means of a broken line. The current crest of the 8-year cycle comes ideally at the end of the third quarter in 1952. The 8-year cycle has an average strength of about 28.6% of trend at crest, about 71.4% of trend at trough. Troughs come ideally four years after crests.

The 6-Year Cycle

There is also a 6-year cycle present in these figures, discovered in 1949, as I told you in my report for December 1950. So that you can see it more clearly, I have adjusted the data for the effect of the 8-year cycle, to obtain the values plotted in Fig. 3. A 7-year moving average trend is also shown. By computing the deviations from trend, we obtain the values shown in Fig. 4. To this curve I have added a diagram of the ideal 6-year cycle. With four more years of data it is possible to revise the amplitude, shape, and timing of the 6-year cycle, as compared with the determination of 1949.

A 2-Year Cycle Also

The 8-year cycle is of the usual zigzag shape but the 6-year cycle is flat on top and bottom as it would be if there were a concurrent 2-year cycle with crests one year before and one year after the tops of the 6-year cycle. However, the work has not yet been done to separate the 2-year cycle from the 6-year cycle to make sure.

The current crest of the 6-year cycle comes ideally mid-1954. It has an average strength of 107.7% of trend at crest, 92.3% of trend at trough. Like the 8-year cycle, it is symmetrical, troughs falling three years after crests.

You will note that in this study I have used a 7-year moving average trend as a base from which to compute both the 8-year and the 6-year cycles. The length of the moving average used for the trend need not be the same as the length of the cycle,

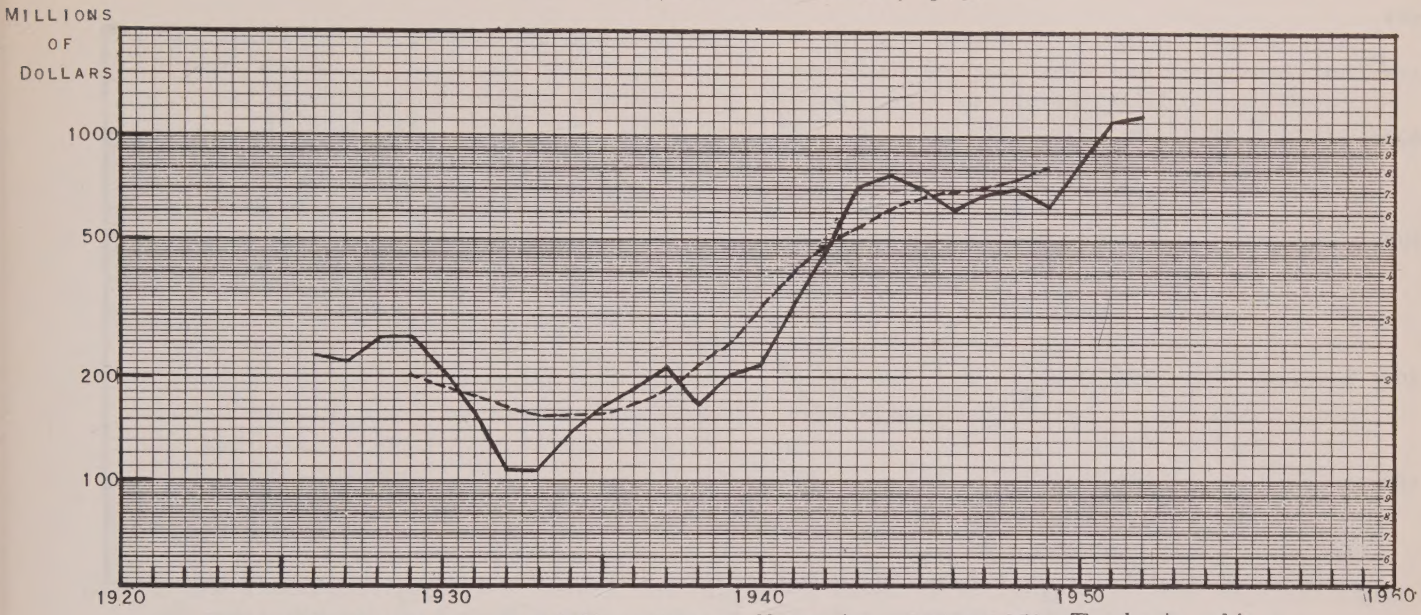


Fig. 1. Goodyear Tire and Rubber Company Net Sales, 1926—1952. The broken line shows the 7-year moving average trend. Ratio Scale.

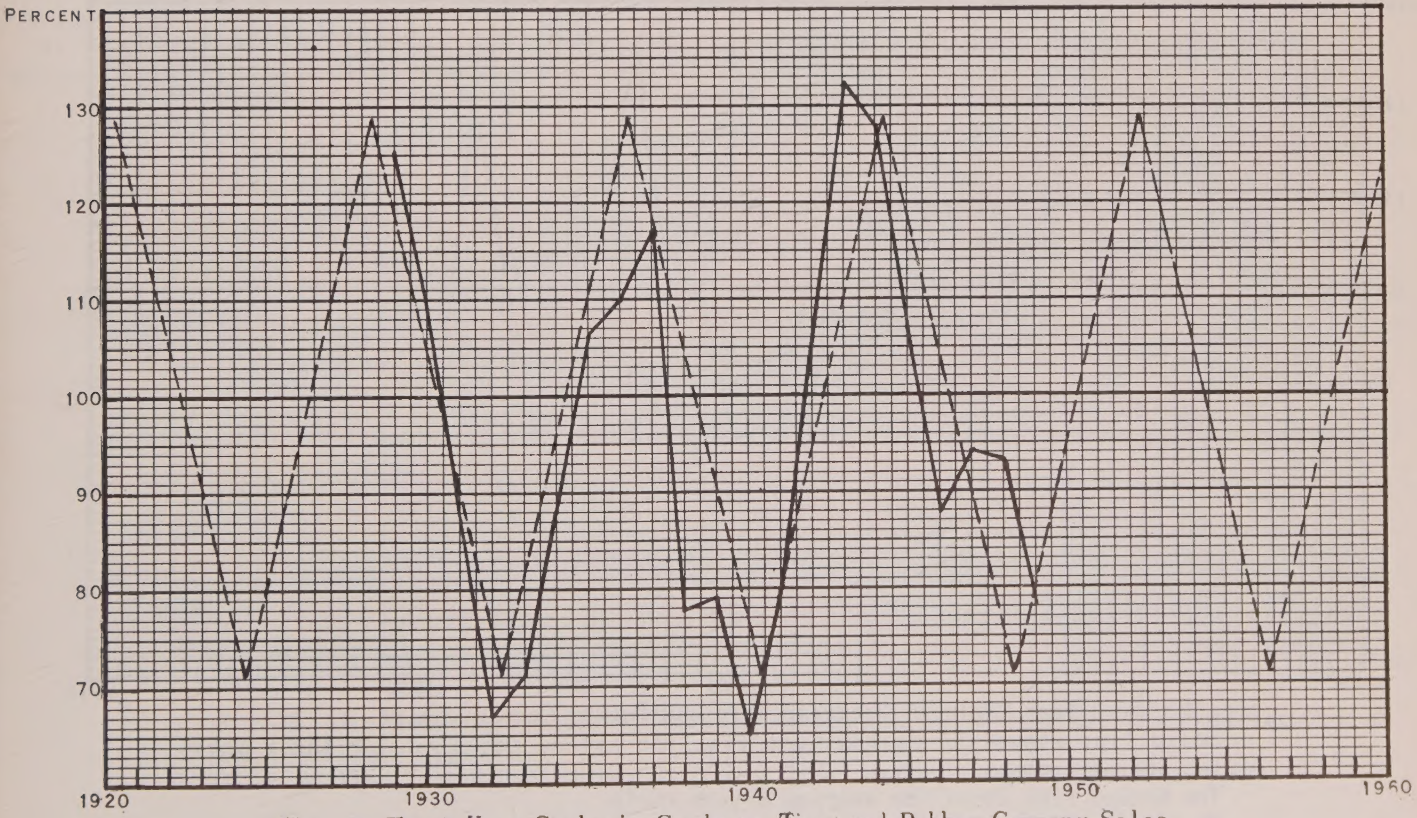


Fig. 2. The 8-Year Cycle in Goodyear Tire and Rubber Company Sales. The solid line shows the percentages that sales are of trend.

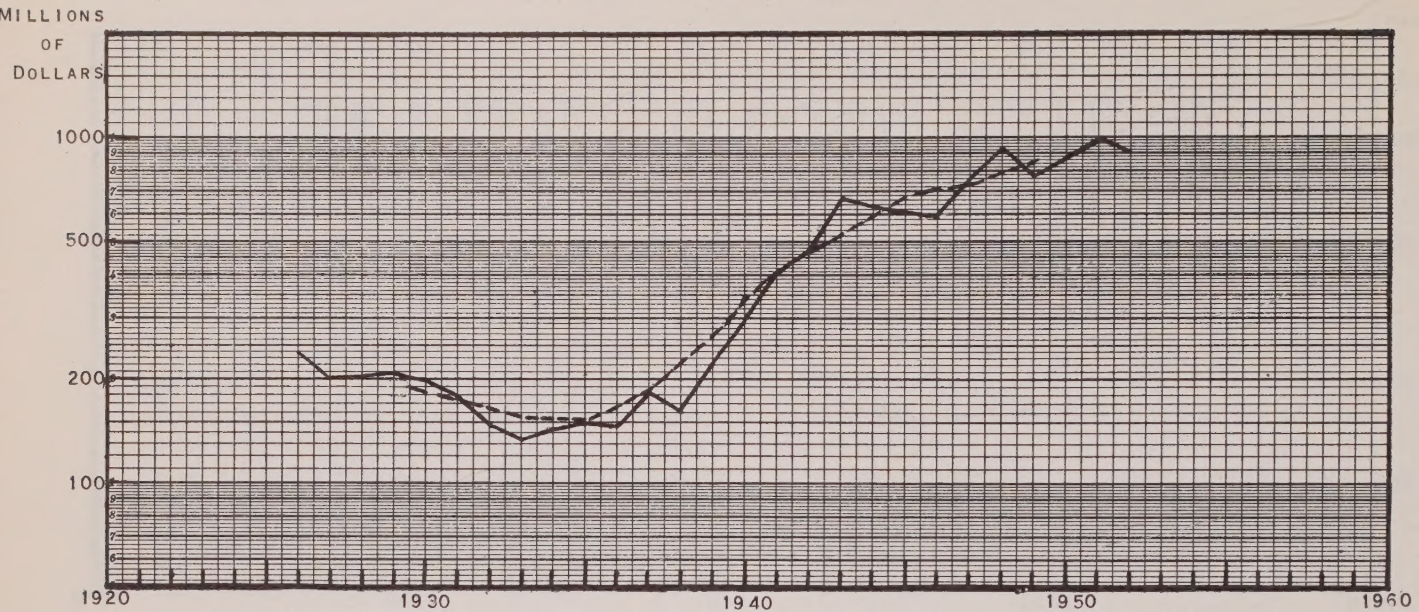


Fig. 3. Goodyear Tire and Rubber Company Net Sales, 1926--1952, adjusted for the Effect of the Ideal 8-Year Cycle. This curve shows what Goodyear sales would have been if there had been no 8-year cycle.

The broken line shows a 7-year moving average trend. Ratio Scale.

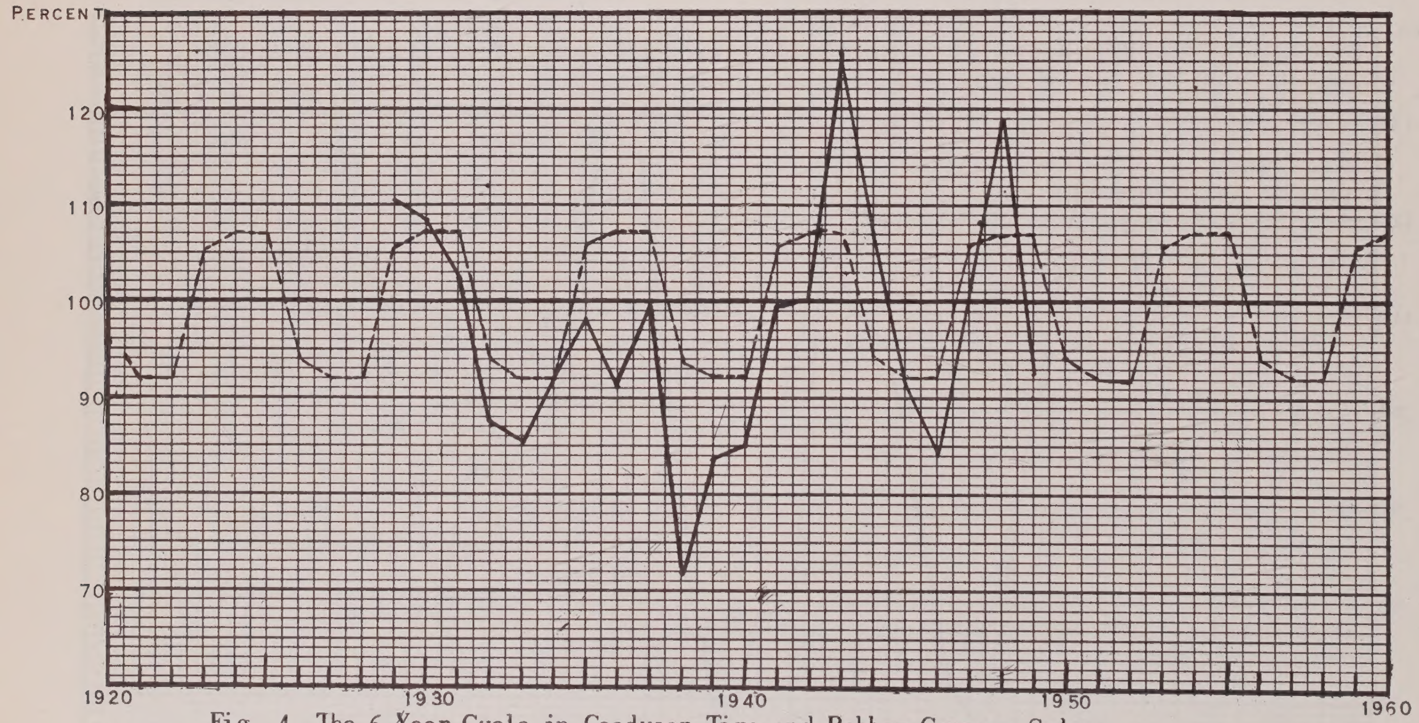


Fig. 4. The 6-Year Cycle in Goodyear Tire and Rubber Company Sales.

Solid line shows the percentages that the sales, adjusted for the 8-year cycle, are of trend.

The broken line shows the average 6-year cycle.

The peculiar shape of this average cycle may be due to the concurrent presence of a 2-year cycle cresting in odd years.

even though it is usual, for simplicity, to make it so.

Fig. 5 shows the values plotted in Fig. 3, adjusted for the 6-year cycle as well. These values represent other cycles, trend, inflation, and random factors.

Adjusting Sales to a Gold Basis

It may be worth while to carry the analysis one step further and show you the sales of Goodyear adjusted to a gold basis, in accordance with the number of paper dollars required to buy a gold dollar on the black market in New York. See the broken line I have added to Fig. 5. This curve represents trend, war distortions, other random factors, other cycles not yet determined, and any fluctuation which may have been introduced by errors in the determination of the shape, timing, and amplitude of the 6- and 8-year cycles.

Fig. 6 shows a combination of the idealized 8-year cycle and the idealized 6-year cycle projected to 1960. The combination of 6- and 8-year patterns repeats every 48 years. If these cycles are significant and continue, insofar as these two cycles govern the sales of Goodyear, the percentage deviations from trend will repeat every 48 years also.

The Future

What of the future?

In the first place you must keep in mind that this series of figures is so short that the cycles which we find in it may have been present merely by accident. If we had records to show that the 8-year and 6-year cycles in these figures had been present consistently back to 1900 for example, we could have much more faith in their probable continuation.

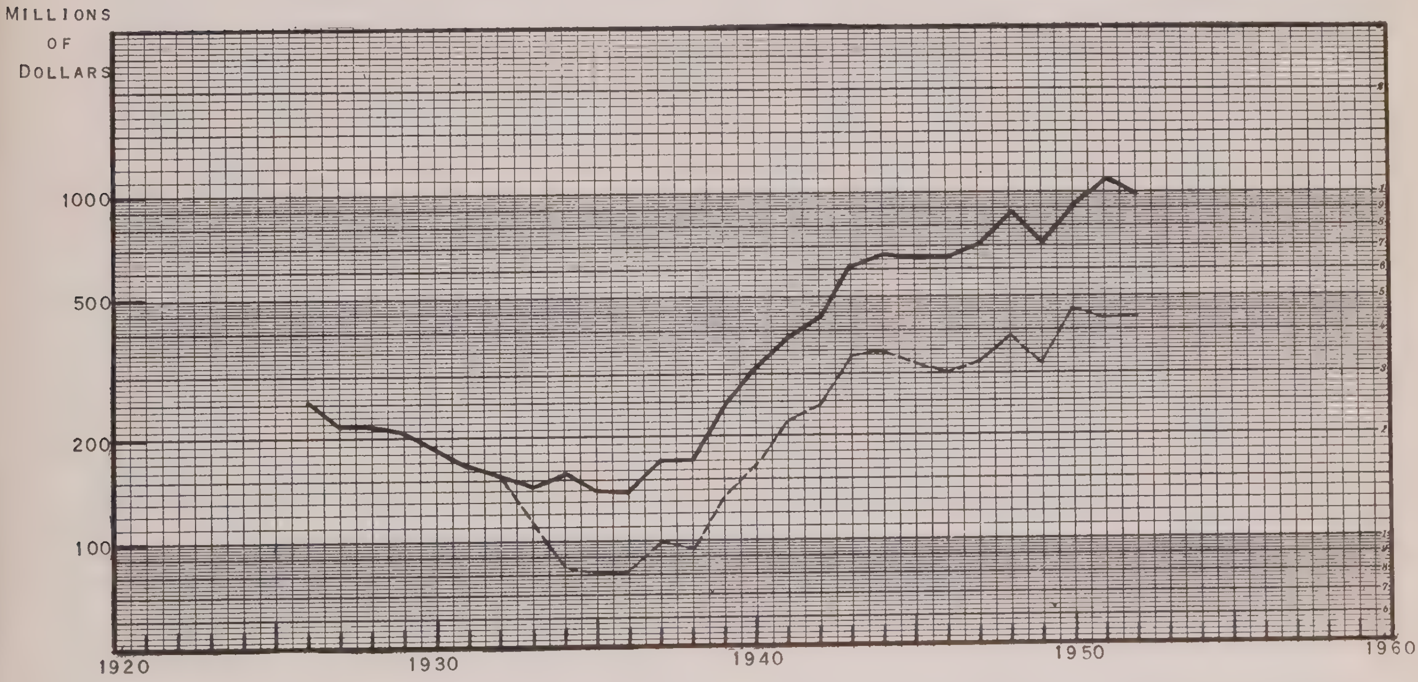


Fig. 5. The Remainder. Goodyear sales adjusted for the 6-year cycle as well as for the 8-year cycle.
Solid line, values in currency. Broken line, values in gold. Ratio Scale.

On the other hand, we must do with what we have. The cycles which have been present for the past 28 years suggest a rise from 1952 to 1953, at which time sales should be about 25% above trend. From 1953 the normal cyclic behavior as determined above suggests a decline to about 30% below trend in 1956. Thereafter there should be a rapid and important recovery, due to reach its climax in 1960.

This projection, like a weather forecast, can certainly not be depended upon absolutely, but if I were you I'd carry an umbrella so that if things should turn out this way you will not get too wet. As Mr. Roger Babson has said, errors of caution leave no wreckage in their wake, but when the business direction is down, errors of overoptimism can be fatal.

E.R.D.

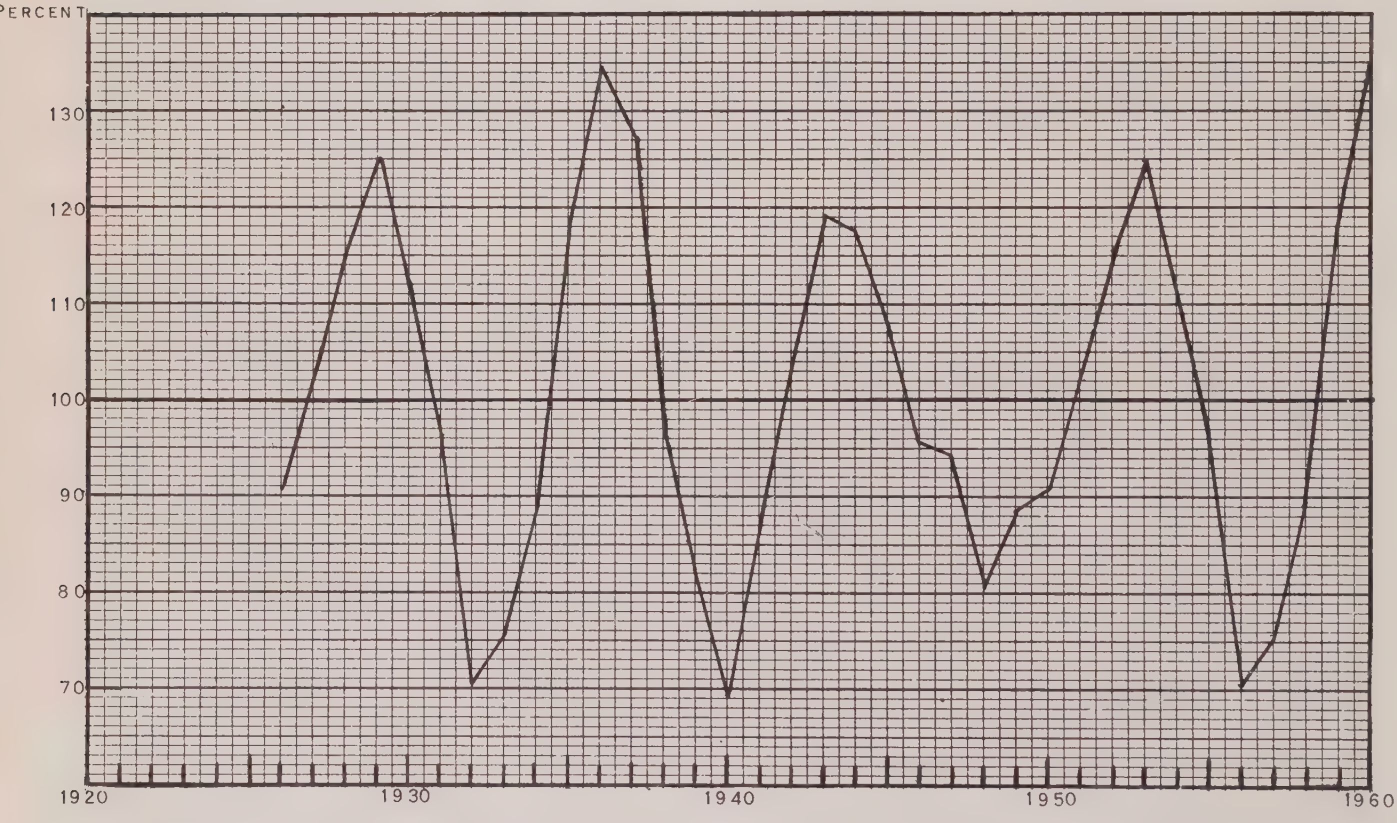


Fig. 6. A Synthesis of the Ideal 8-Year and the Average 6-Year Cycle in Goodyear Tire and Rubber Company Net Sales, 1926-through 1960.

How it Came Out

THE 6-YEAR CYCLE IN

PITTSBURGH PLATE GLASS COMPANY SALES

Summary: The 6-year cycle in the net sales of the Pittsburgh Plate Glass Company has continued since its discovery five years ago. It crests ideally in 1953, troughs ideally in 1957. Typically, this cycle goes from 115.8% of trend at time of crest to 86.8% of trend at time of trough. If, quite arbitrarily and merely for purposes of illustration, we assume trend level at $400,000,000 these percentages would correspond to a decline of $116,000,000 from crest to trough. Any increase of trend during the four year period would of course decrease the decline to compensate.

MY records show that it was April 19, 1949 on which I first observed a 6-year cycle in the net sales of the Pittsburgh Plate Glass Company. How has this cycle worked out since discovery? What light does it throw on the company's probable future sales?

Fig. 1 shows the sales of the company 1905 through 1952, thus including the four new figures which have become available since the cycle was discovered. Fig. 1 also shows by means of a broken line, a 6-year moving average trend. Likewise, it has arrows to mark the ideal (typical) time of the highs of the 6-year cycle.

Fig. 2 shows the percentages by which actual sales were above or below trend. Basically Fig. 2 is the same as Fig. 1 except that the trend has been pulled straight, as it were, and the vertical scale has been exaggerated. A broken zig-zag line diagrams the typical *timing* of the 6-year cycle. As a 6-year moving average trend looses 3 values at each end, Fig. 2 is unable to show values for 1950, 1951, and 1952, until we know actual sales for 1953, 1954, 1955. This makes no difference as far as the 6-year cycle is concerned, however.

Fig. 2 shows, by means of a heavy line, the way in which the 6-year cycle in these figures has unfolded since discovery (because in 1949 the original of Fig. 2 could of course be plotted only to 1945).

Fig. 3 shows the net sales of Pittsburgh Plate Glass adjusted for the effect of a perfectly regular 6-year cycle. That is, Fig. 3 shows the elements you would *not* have been able to forecast, even if, in 1905, you had known all about the 6-year cycle in these figures. These elements include (a) other cycles, (b) accidental factors, (c) war distortions, (d) trend, and (e) inflation.

A knowledge of cycles is only the begining of a forecast. At least three other cycles in the sales of the Pittsburgh Plate Glass Company are easily visible by inspection of Fig. 3, but their isolation, verification, and evaluation must await another report. Then too, after all the various cycles have been adjusted for, trend and inflation factors must be unscrambled and each projected separately. Finally all must be combined or synthesized into a probable net effect—the forecast.

The little zig-zag line at the top of Fig. 3 diagrams the 6-year cycle correct for amplitude and timing. Note that it goes down for four years and goes up for two years. Note also that a crest of the 6-year cycle was due in 1953, and that the 6-year cycle is due to exert a downward force for the next four years.

Do not be misled by the apparent insignificance of the 6-year cycle. Typically the 6-year cycle in the sales of Pitts-

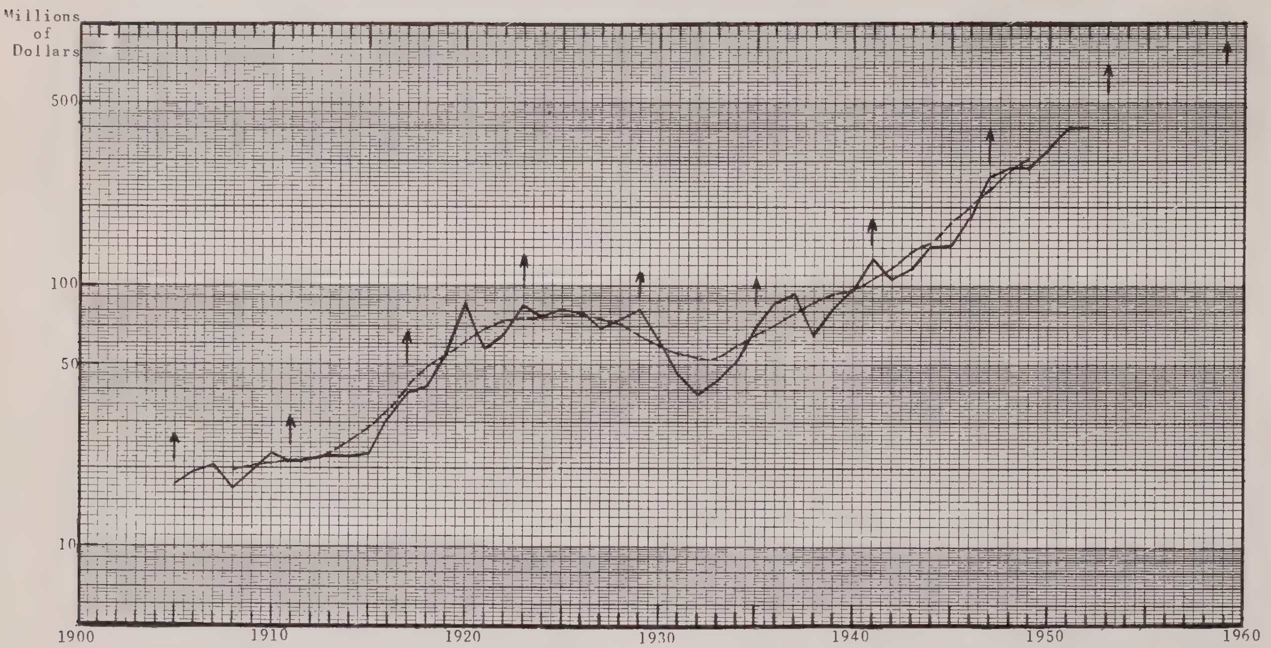


Fig. 1. Pittsburgh Plate Glass Company Net Dollar Sales, 1905—1952, Together with a 6-Year Moving Average Trend. Arrows indicate the time of the ideal high of the 6-year cycle. Ratio Scale.

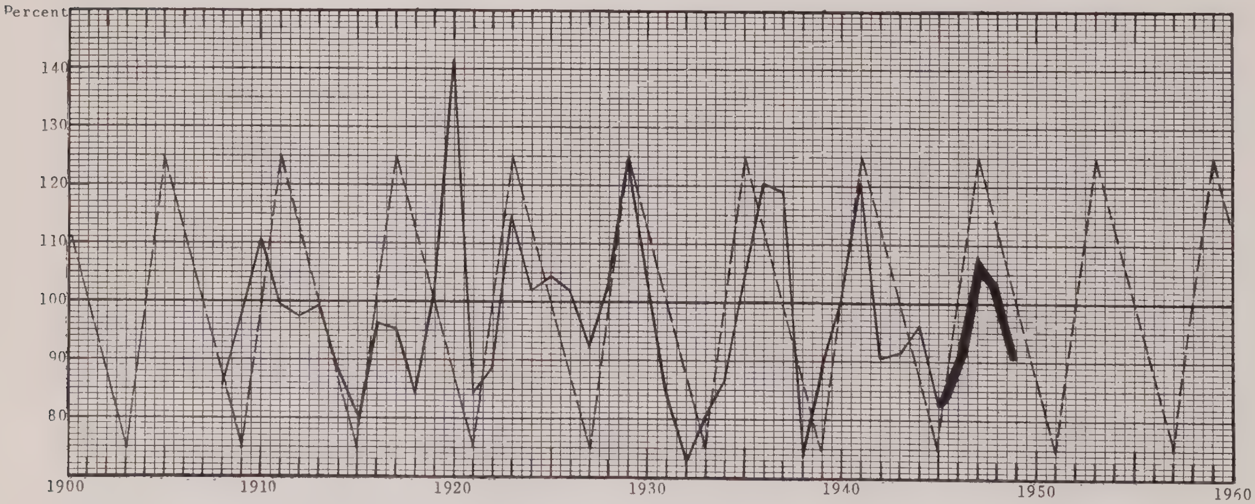


Fig. 2. Pittsburgh Plate Glass Company Net Dollar Sales. Data expressed as percentages of trend. Note that curve ends in 1949 because a 6-year moving average loses three years at each end. Timing of the typical 6-year cycle is shown by means of a broken line.

The heavy line from 1945 through 1949 shows the extent to which the behavior of these years conformed to the forecast. Note that the low in 1945 and the high in 1947 both came exactly in accordance with expectations, and that both the lows and the high were of about typical amplitude.

burgh Plate Glass runs from 115.8% of trend at year of crest to 86.8% of trend at year of trough, a decline of 29% of trend. If, quite arbitrarily and merely for purposes of illustration, we assume trend to be *level* at 400 million dollars, the 6-year cycle would account for a decline of 116 million dollars—a very considerable amount of money. Of course, insofar as trend goes up during the 4-year interval, the decline would be correspondingly decreased.

Fig. 4 shows a diagram of the 6-year cycle as originally determined back in 1949. With the additional figures now available, it is possible to re-determine the shape, amplitude, and timing of this cycle with somewhat greater accuracy. This has been done and revised values are shown in Fig. 5. Note that there is no change in the timing of this cycle, but that the revision has increased the amplitude.

Note also that this cycle is irregular in shape, possibly due to the concurrent presence of other cycles which are exact fractions of 6 years.

It is not my purpose in this article to attempt to forecast the probable future sales of the Pittsburgh Plate Glass Company. The object here is merely to see how the 6-year cycle in its sales—one of many factors needed for a forecast—has come out since discovery.

As you can see by reference to Fig. 2, it came out very well. The low of 1945 came exactly on time, and so did the high of 1947. This precision is partly a matter of beginner's luck, it cannot be expected to continue.

Of the seven highs, four came on time, one came 1 year early, one came 1½ years late, and one, in 1920, came all of three years late. Similar distortions are to be expected in the future.

Of the seven lows, three came on time, two were a year early, and one, the low of 1907, was at least a year early. Lows in the future are of course subject to simi-

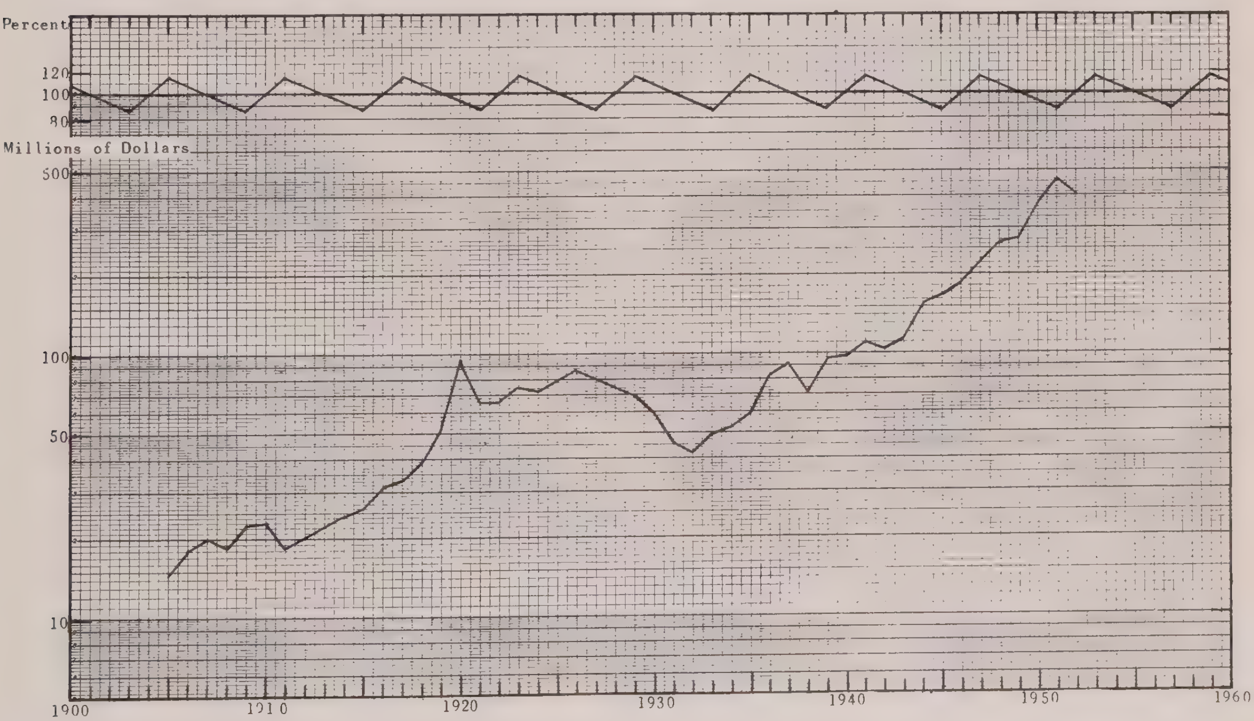


Fig. 3. Pittsburgh Plate Glass Company Net Dollar Sales, 1905—1952, Adjusted for the Effect of a Perfectly Regular 6-Year Cycle of Typical Amplitude.

A diagram of the 6-year cycle correct for amplitude and timing is shown at the top of the chart.

This chart shows what the sales of the Pittsburgh Plate Glass Company would have been if there had been no 6-year cycle operating.

lar variations.

A knowledge of one cycle alone is totally inadequate for precise forecasting. Nevertheless, it should be helpful to all concerned to know first, that the 6-year cycle has continued since discovery; and second to know that it is due to exert an important depressing effect upon the sales of this company for the next four years.

E.R.D.

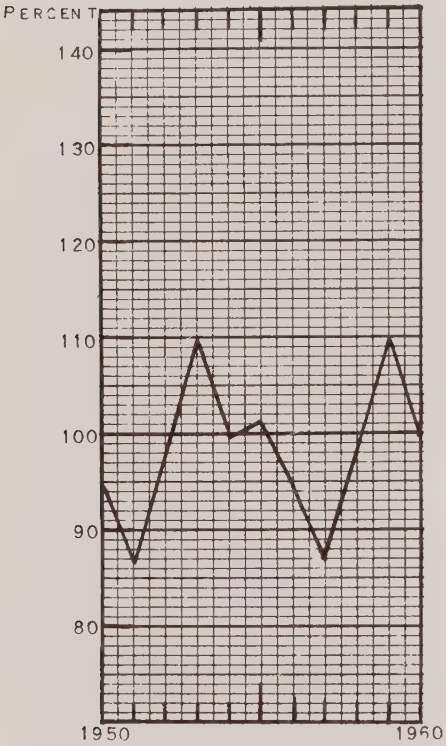


Fig. 4. The 6-Year Cycle as originally determined from six cycles.

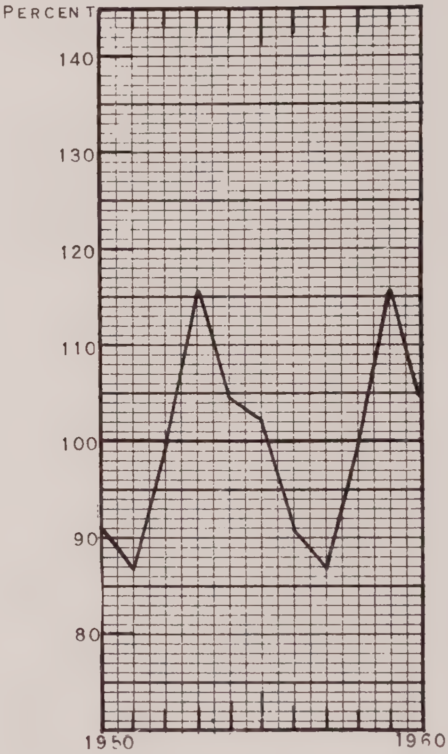


Fig. 5. Revised 6-Year Cycle based on typical values for seven cycles.

The timing remains the same but with more figures the typical amplitude is found to be larger than seemed to be the case in 1948.

Letters

Some New Sunspot Work

Dear Ned:

...My periodogram is now complete but I will need several months to study my results and some time to prepare charts and tables. I have uncovered some very exciting correlations which must be tested some way to find out their meaning.

My periodogram of the shorter cycles shows a series of harmonics of 168 years as follows:

Length in Years	Harmonic	Length times Harmonic
11.25000	15	168.75
10.59722	16	169.56
9.93421	17	168.88
9.30000	18	167.40
8.76190	19	166.48
8.35870	20	167.17
7.60000	22	167.20

The average of these is 167.92 or almost twice the 84 year orbit time of Uranus, and I do find a very clear 84-year cycle with peaks following 1777, 1861, and 1945, when the north pole of Uranus was pointing directly towards the sun.

Of the shorter cycles, the 11.25- and the 9.93-year cycles are the most important. The 11.25-year is exactly the length of the quarter synodic period of Saturn and Uranus for the period studied and the 9.93-year is exactly one-half the synodic period of Jupiter and Saturn. In fact, if I start each line of a periodic table with a certain position of the planets, a much stronger cycle can be shown than with a periodic table with uniform lengths of the lines...

Sincerely,
Gerould T. Lane

Rochester, New York

More About the 52-Year Cycle in Aztec Civilization

Dear Mr. Dewey:

In continuation of research in regard to Kondratieff's 54-year cycle I have just come across an article by Neil Merton Judd in the National Geographic Magazine of January 1948, who states relative to the Aztec civilization:

"Among the Aztec temples in use at the time of the Spanish Conquest none is more representative than that of Tenayuca, six miles north of Mexico City.......According to the Mexican archeologists who excavated it, this snake temple was rebuilt five or six times.

"Periodic temple reconstruction was one means of attaining the ceremonial purity required by the Nahuatl peoples. On the first day of each year temple furnishings were renewed, dwellings were swept with unusual care, and all kitchen utensils were broken and discarded.

"Every *52-years* brought a major renewal rite, a spiritual and material rebirth. The old was cast off and life began anew. Even personal clothing and household furniture were replaced. Temples no less than houses were rebuilt. After burning 52 years the altar fires were extinguished and a new one kindled. From this new fire live coals were hurried to relight the hearth in every home."

This rebuilding of the Tenayuca temple five or six times would carry the cycles back to the late tenth century. But the Aztec civilization was merely the latest of the culture and was preceded by much earlier ones in which the re-occurrent cycle manifested themselves as described by Judd:

"Cholula was a holy place, a Mecca, even in early times. Its unknown founders created a religeous center by grouping their shrines and altars. Subsequently this center was half buried beneath a new agglomeration of shrines, altar platforms, and associated structures when Toltec peoples invaded the valley sometime in the sixth or seventh century.

"Thereafter, for 400 or 500 years, reconstruction or substitution were recurrent; complete replacement accompanied the New Fire Ceremony every 52 years."

These facts carry the "Aztec Calendar" re-occurring periodic cycle, as a matter of record, to the sixth or seventh century. However the cycle was certainly well established prior to this time. Therefore, if this cycle can be identified with the Kondratieff, as seems not unlikely, there exists in the pre-Hispanic Mexican civilizations a substantiation of the phenomena—in the great number of reoccurrances—not approached in modern studies, either in the positive nature of the manifestations or in the length of time encompassed.

Very sincerely,
Connell C. McRae

San Jose, California

Editor's Note:

Mr. McRae is the man who supplied the material printed on page 324 of our November report, but permission to use his name did not come through in time to give him credit at that place. It is a pleasure to do so now and to thank him for this additional information.

How Do You Find Cycles?

Gentlemen:

I am a new subscriber and being a retired businessman and interested in the study of cycles, I would like to know how one goes about trying to find cycles and synthesize them.

Sincerely,

Modesto, California

In Reply I Said:

Dear Mr.

I am glad to know you plan to do some cycle research. I think you can get a lot of help from back copies of our monthly reports. I enclose a publication list so that you can see the contents of all the reports we have issued so far.

I think you will find the report for February 1953 of special interest. It contains a cycle study worked in full detail including the arithmetic.

I am now in the process of writing a book called, "How to Make a Cycle Analysis." When this book is printed, I think it will be of help to you also.

Also, we are now offering a correspondence course in cycle analysis, if enough people are interested to make such an activity worth while.

Very cordially yours,

Two Types of Cycles

Dear Mr. Dewey:

The reading of your book and of your monthly report plus my own investment research work, prompt me to raise some points of inquiry.

The question has grown in my mind over several years, whether sufficient attention is being paid to a distinction which I think I see, between two basically different types of cycles. It appears that one type may be classed generally as the "natural" type, occuring in the many periodicities discovered in plant and animal life, including man himself, and in various other terrestrial and celestial phenomena. For the purposes of the distinction, the significant fact lies in the unimpressed tourist's comment on the great volume of water pouring over Niagara Falls: "Well, what's to hinder?" It is either impossible for man to interfere with such cycles, or there is insufficient emotional or material incentive to do so.

By contrast, in the area of those periodicities which exist in or are reflected in markets and market prices, isn't it true that the very existence of statistical variations often provide highly important and often determinative motivations for altering those variations, in direction, in amplitude or in phase? There comes to mind a distinction which I once heard between gambling and speculation, to the effect that the gambler's action has no effect upon the outcome of his gamble, while the speculator's action (or the action of any buyer or seller in a market) *does*, by influencing the supply of or demand for, the commodity or service involved, have an effect, however infinitesimal in the single instance, upon the market price. Integrated through an entire group of buyers and sellers who comprise the market at a given time and who successively enter and leave it, the effect may be determinative of price.

Those in the market are, one would assume, acting to anticipate, if not to bring about, a variation which is to their interest—to their conflicting interests, in fact. They are using that unique quality of man, imagination, the visulization of a future condition that is different from today's condition. Even if we concede that in the long run, there are impersonal and objective developments which are the generating causes of changes in supply and demand, or corporate earnings, or even if we concede that there are also in operation mass changes in emotions arising from celestial perturbations, or sunspots or ozone content, it seems almost inevitable that man will attempt to utilize all knowledge that he may come to possess of these forces, to manipulate their effects upon the variable in which he has a monetary interest. The net effect of this would seem to be at least a change in phase or timing of what would have been otherwise the "natural" or unforced, undistorted cycles in the variable. The phenomenon, in fact, constitutes something very much like an inverse feedback circuit —a line of analysis which I hope to see followed.

If the above analysis is valid, it would appear that we can expect in periodicities of this latter general type, a much higher prevalence of "random" variations. The more knowledge we have of such cycles, the better disseminated it is, and the more persons apply intelligently the forestalling techniques thus available to them, the less predictable in direction, amplitude and phase would be the resulting variations. Perhaps, too, the smaller in amplitude.

Such a conclusion, if justified, doesn't at all lead me to advocate any less research on market cycles, for at least it leaves me with the hope of being one of that well-informed "early minority" who will, more than half the time, start to zag while others are still zigging. But, if correct, it should temper any optimistic expectations that there is some formula which, if discovered, would remain valid and permit the possessor to operate consistently with a high degree of success. Doubtless less analysis than the above would suffice to dispel that fond hope—and yet it is an age-old illusion that dies hard. And the distinction, if valid, should make us more realistic in appraising the limitations of what can be done with cycles in markets. And of all the markets, it would appear that the price of common stocks has more monetary incentive to forestall and predict, and has engaged the close and intense attention of more intelligent persons, than any other. It is precisely for this reason that one would expect results to be least predictable in this field. Success in solving (at least partially and temporarily) its secrets, is a self-defeating accomplishment, to the extent that the knowledge is successfully used by the discoverer or by others.

Quite possibly I am belaboring a point which would be readily conceded, and I have elaborated on it above only to present adequately the facts and what I laughingly call the logic of the argument. Perhaps I am inclined toward a slightly skeptical thesis after having watched numerous stock price forecasting "systems" fail in practice after having been developed by a process of successful backcasting. And I don't recall having heard or read any comment on what appears to me to be a rather important distinction.

Cordially,
Robert W. Storer

The Manufacturers National Bank
Detroit, Michigan

In Reply I Said:

Dear Mr. Storer:

If enough people know about cycles in prices or production of anything *and act upon their knowledge,* the cycle should be wholly or partly eliminated.

How many people would have to know about the cycles in a given stock, let us say, and have the courage to act upon their knowledge, before their actions had an effect upon the prices I do not know.

Thanks immensely for your letter and for your encouragement.

Very cordially yours,

Foundation Affairs

1954 Summer Fellowship

THE Foundation announces with pleasure the receipt of a grant from the L. Peter Cogan Foundation, Inc., which it plans to use for a cycle research fellowship during the summer of 1954 in the field of botany, zoology, medicine, economics, or sociology. Cycle research, as you know, is concerned with the analysis of rhythmic fluctuations—the ups and downs in animal life, weather, disease, and other biological, physical, and geological phenomena, which occur at reasonably regular time intervals.

The Foundation will accept applications for the fellowship from candidates with training in statistics and in botany, zoology, medicine, economics, or sociology. The selected candidate will work at East Brady, Pennsylvania under my direction.

The Foundation's 1953 summer research fellowship was awarded to Dr. Lauri Siivonen, Professor of Zoology at the University of Helsinki and Managing Director of the Finnish Game Foundation, who visited the United States from Finland last summer to work at Foundation research headquarters.

Organized in 1952 by L. Peter Cogan, a merchandise manager at Abraham & Straus, to aid charitable, scientific, educational and literary organizations, The L. Peter Cogan Foundation is also supporting research in the natural and social sciences. It is currently interested in a common cold research project.

Mr. Cogan, a Phi Beta Kappa graduate of Tufts College and the Harvard Graduate School of Business Administration, is President of the Foundation. Its directors include Abraham Pollen, M. D., Harvard Medical School and Massachusetts General Hospital, and David H. Cogan, president, CBS-Columbia.

E.R.D.

L. Peter Cogan

THE CORRESPONDENCE COURSE

A CONSIDERABLE amount of interest has been expressed in the correspondence course announced on the back cover of our reports for November and December. This course will be called "How to Make a Cycle Analysis."

To conform to the wishes of at least some of the persons who want to take it, it has been decided to break the course into two parts: Elementary Cycle Analysis, and Advanced Cycle Analysis. If enough people want it, Elementary Cycle Analysis will be given now. If enough graduates of Elementary Cycle Analysis want it, Advanced Cycle Analysis will be given later.

Cycle analysis is a very specialized branch of statistics. Elementary Cycle Analysis is a course at college level. However, I see no reason why any intelligent high school graduate with a good knowledge of arithmetic and some competence in the use of figures can not pass it successfully.

No mathematics except arithmetic are required as a prerequisite.

The course is a practical one designed to teach you the elements of how (a) to find cycles, (b) to determine their lengths, strengths, shapes, and timings, (c) to isolate them, (d) to evaluate them, (e) to combine them, and (f) to project them into the future.

Problems will be provided to be worked by the student. Papers will be corrected at Foundation headquarters and returned with comments.

As tentatively outlined, the course, Elementary Cycle Analysis, will include the eighteen following lessons:

1. Basic concepts. Outline—how to make a cycle analysis. The processes of analysis and synthesis.
2. Charts and charting to reveal cycles.
3. How to find hints of cycles.
4. The use of numbers. Logarithms. The slide rule. Machines.
5. How to make and use arithmetic and geometric moving averages in cycle analysis.
6. How to make and use deviations from the moving average in cycle analysis.
7. How to make and use time charts in cycle analysis.
8. The time chart—continued.
9. How to make and use periodic tables in cycle analysis.
10. The periodic table—continued.
11. How to make and use section moving averages in cycle analysis.
12. How to make and use moving differences and moving ratios in cycle analysis.
13. Filtering.
14. Reversing cycles.
15. How to idealize cycles and how to adjust for cycles.
16. Tests of significance.
17. The periodogram.
18. The determination of trend. The projection of cycles.

As you can see from the above outline, even graduate engineers and statisticians will find most of the course completely different from their previous studies. In fact, the only part of the course which will overlap with statistical courses as taught in colleges will be Lesson 2, Charts and charting, and Lesson 4, The use of numbers—Logarithms—The slide rule—Machines.

The course should take about a half-year. It will be designed to occupy the average student about an hour and a half a night for five nights a week, but the amount of time can be increased or decreased at the collective wish of the persons who take the course.

The exact price of Elementary Cycle Analysis has not yet been set. It will depend upon how many persons finally decide to take the course. I think, however, that it will be in the neighborhood of $145. This will cover instructions, text, and supplies.

If you are interested and have not already written, please do so at once, giving your educational background.

Send your letter to the Director, Foundation for the Study of Cycles, East Brady, Pennsylvania.

E.R.D.

Questions & Answers

Question:

As we expand, will our booms and depressions become more severe?

Answer:

I do not think there is any evidence to support the idea that depressions are getting consistently worse relative to trend, but as trend flattens we loose the upward force of growth to minimize depressions on the way down, and to speed the way to recovery on the way up.

Question:

Are charts of the sort you show in your book in Chapter 3 and 4 pretty well studied and depended upon in big business today?

Answer:

To some extent, but the charts used by many firms fail to go back far enough to give them adequate perspective. Also, many firms persist in using arithmetic charts instead of ratio scale or semi-logarithmic charts. Arithmetic charts can be very misleading if one is interested either in cycles or in growth trends.

Question:

Why did you say that the post-war sales volume of electrical refrigerators would probably not be sufficient to break established growth patterns?

Answer:

Growth patterns are pretty fundamental and, when once established, are not likely to be broken by anything, even though from time to time there may be distortions.

Question:

How is it possible for an industry to have a great many of the different rhythms?

Answer:

I do not know why this is so, but it is.

One explanation might be that there are many rhythmic forces in our environment, and that certain businesses respond to some of them more than to others.

The analogy of light may help us here. We know that we are surrounded by light waves of all lengths. However, it is the nature of my necktie to respond only to the red light and for yours to respond only to the blue.

Question:

Do you consider the PREDIX charts worth the $9.00 Mr. Hughey asks?

Answer:

If Mr. Hughey's cycle studies can predict market movements, they are virtually priceless. If they do not do so. better than not, they are worthless. I should think that for anyone interested in the market, the $9.00 would be a very good gamble. For once, you might get back more than you pay.

Question:

Will the discovery of atomic energy affect our political, economic, philosophical, and social institutions enough to bring about a renaissance in our population growth?

Answer:

I do not know. However, my conjecture is that instead of a renaissance or rebirth we are more likely to have a decimation, especially in this country with its extreme concentration of population and consequent vulnerability to atomic attack.

Note:

The questions given below were asked by students in a college course where Cycles—The Science of Prediction *was used as a textbook. In general the questions chosen refer to Chapter VI, about the 54-year cycle, and Chapter VII, about the 9-year cycle.*

Question:

What is meant by Schumpter's statement (page 87) that Juglar's work pushed the crisis into the background?

Answer:

Juglar told people (a) that business figures went up and down in *waves*, and (b) that the turning points of these waves were *rhythmic*. That is, that the tops and bottoms of these waves came at reasonably regular time intervals.

Juglar first wrote about business cycles in 1856. The waves of which he spoke have kept coming true for 100 years.

Economists now realize that business does go up and down in cycles; but as yet most of them do not realize the extent of the regularity which prevails in these ups and downs.

Intellectually, businessmen also know that it is normal for business to go up and down in cycles.

However most businessmen of my acquaintance have not yet accepted this idea emotionally. That is, most of my friends say, in effect, "Business is going up. It's wonderful." or "Business is going down. It's terrible." Only a few say, "Business is going up. We must therefore prepare for the coming down turn." or "Business is going down. We must get ready for the upturn which will follow.

Even fewer executives say, "Our business will reach a top and turn down (or a bottom and turn up) at such and such a time because our business conforms to such and such combination of rhythmic cycles."

Question:

Which rhythm is of most importance in our economic planning?

Answer:

There is no one most important rhythm. Each series of figures behaves differently. The most important rhythm in one series of figures may be relatively unimportant in another.

Question:

Why does Schumpter (quoted on page 91) refer to 1825-1830 when the charts do not show this period? I cannot see much comparison in the periods of 1875-1878 and 1929-1934.

Answer:

Schumpter is talking about *depressions* and the charts you refer to graph *common stock prices*. Business activity and common stock prices do not necessarily go up and down together. You cannot assume that the rhythmic cycles you see in one series of figures will be present in another series. Each series of figures must be examined separately.

Question:

Why can't the true length of a cycle be determined for certain?

Answer:

The tops and bottoms of the various waves are distorted so much by accidental variations that it is impossible to tell the exact timing of the cycle as such.

As you have more and more repetitions of the cycle, these distortions can be averaged out and one can get closer and closer to the true length. But mostly, our series of figures are not long enough to give us as much accuracy as we wish.

Question:

Aren't more businessmen now using a knowledge of cycles than before 1929?

Answer:

I would say so, definitely.

Additions to the Library

"Further Researches into the Physical Reality of Some Long-Period Cycles in the Barometric Pressure of Batavia," by Dr. H. J. de Boer. Verhandelingen 30, Meteorological and Geophysical Service, Department of Public Works and Communication, Batavia, 1946, Twenty-eight pages, 23 figures. Gift of the author.

Dr. de Boer is Professor of Physics and Meteorology, Faculty of Agricultural Science, University of Indonesia, at Bogor.

Dr. de Boer has made a new periodic analysis of the pressure-curve of Batavia with the aid of the sign coefficient method and finds cycles with an average length of 2.34, 3.36, 5.97, 7.32, 8.47, 11.12, and 15.87 years. To these he adds the Brueckner cycle of 36 years which, as he says, could have been found only in a longer series of observations.

This paper advances the hypothesis that there are four real cycles 3.36 years (40.32 months), 7.32 years (87.34 months), 11.12 years (133.44 months), and 36 years long respectively, and that the other four cycles are unreal cycles due to a variation of the amplitude of the four real cycles.

• • •

"Snowy Owl Migration—1930-1931," by Alfred O. Gross, reprinted from *The Auk*, Vol. XLVIII, No. 4, October, 1931, 11 pages, 3 figures, 1 plate. Gift of Dr. Gross.

Usually the snowy owl keeps to the northland, but there is a tendency for him to invade southwestern Canada and New England at intervals of about four years.

In his paper Dr. Gross gives the dates of various snowy owl invasions from 1876 forward and shows that, when there have been invasions, their dates correspond to dates of maximum numbers of arctic foxes.

The years of periodic maximum numbers of Arctic foxes	Dates of Snowy Owl invasions as recorded in 'The Auk'
1872	
1876	1876-77
1879	
1882	1882-83
1887	
1890	1889-90
1893	1892-93
1897	1896-97
1901	1901-02
1905	1905-06
1909	
1913	
1917	1917-18
1921	
1926	1926-27
1930	1930-31

Dr. Gross says, "The four-year cycle in the abundance of Arctic foxes and the corresponding regular periods of migration of the Snowy Owls are suggestive that some extraordinary influence is at work."

Snowy Owl caught at Ithaca, N. Y.

EXCERPTS FROM

CYCLES

THE SCIENCE OF PREDICTION

(CHAPTER VII)

by EDWARD R. DEWEY
Director, Foundation for the Study of Cycles

and EDWIN F. DAKIN
Associate, Foundation for the Study of Cycles

TOGETHER WITH 1954 SUPPLEMENT

Originally published by
HENRY HOLT AND COMPANY · NEW YORK

Copyright, 1947, by

HENRY HOLT AND COMPANY, INC.

Published, March, 1947
Second printing before publication
Third printing, April, 1947
Fourth printing, April, 1947
Fifth printing, May, 1947
ADDITIONAL PRINTING, JANUARY 1950

REPRINTED WITH PERMISSION

COPYRIGHT, 1954, BY
FOUNDATION FOR THE STUDY OF CYCLES, INC.

VII

The 9-Year Rhythm

In chapter v we briefly met a rhythm that has been calculated to have a length of very close to 9 years. As previously pointed out, this periodicity should *not* be confused with the 9⅔-year rhythm, that appears in biological phenomena. We shall now meet this rhythm again in company with our 54-year wave, and shall refer to it hereafter as the 9-year rhythm, for purposes of simplicity. It is the rhythm which Schumpeter, without defining its length too closely, likes to call the Juglar cycle, in honor of that pioneering Frenchman:

> His great merit is that he pushed the crisis into the background and that he discovered below it another, much more fundamental, phenomenon. . . . Henceforth, although it took decades for this new view to prevail, the *wave* ousted the *crisis* from the role of protagonist of the play. . . . The problem has again changed its complexion. It is no longer the problem of *the* wave. It is the problem of identifying and, if possible, isolating the many waves and of studying their interference one with each another.[*]

Schumpeter finds his "Juglars" clearly indicated in the economic life of Germany, England, and the United States; by charting percentage deviations of price indices from their 9-year moving averages in these three countries, he produces a chart where the Juglars are apparent even to an undiscerning eye (see Fig. 1).

In our stock market, as well as in commodity prices, we find evidence of an approximate 9-year rhythm clearly stated (see Fig. 2). Figure 3 shows the deviations from trend charted with an ideal 9-year pattern.[*] Rising upon the 54-year rhythm, the shorter wave often serves by its troughs and peaks to mark important events in the economic flow of things. The peak in this 9-year rhythm in 1919, coming at a time when the 54-year rhythm also was reaching toward a crest, coincided with that year's peak in the 3-year moving average of commodity prices, highest in this century (compare Figs. 2 and 3, with 4 and 5).

It was in 1928, again, that this 9-year rhythmic pattern in the stock market once more reached its crest. The top of the 54-year rhythm had already been reached about 1925. In the late twenties, so long as the 9-year rhythm continued rising, the momentum of the market was maintained. But when this rhythm reached its crest in 1928 and then turned after the 54-year rhythm, which had already been going down for three years, the beginning of the great fall was close at hand (compare Figs. 2 and 3).

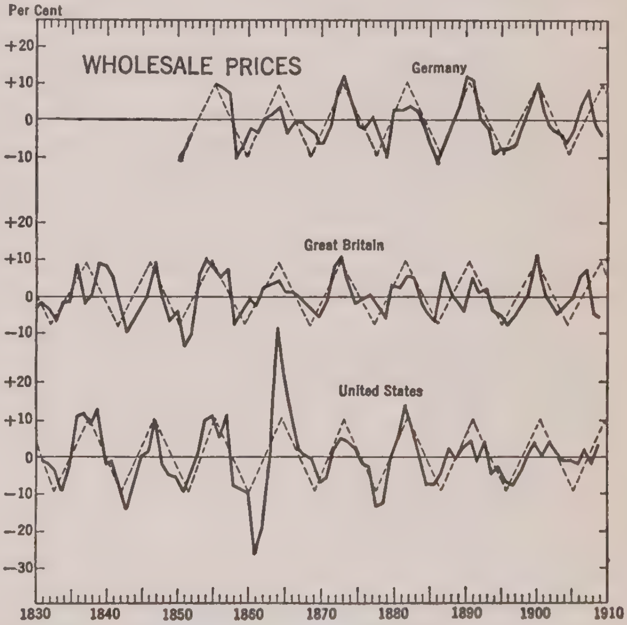


Fig. 1. The 9-Year Rhythm in Prices

Data for Germany, Great Britain, and the United States. Percentage deviations of price indices from their 9-year moving averages, 1830–1910 (after Schumpeter). Regular 9-year cycles have been added.

Inversely, it was after this rhythm had reached a trough in 1923–1924 that the economy started rising expansively to the peak reached in 1928. And it was after its trough in 1932–1933 that re-

[*] *Business Cycles,* p. 163.

Only a few years after Juglar's work appeared in 1860, an American, Samuel Benner, produced a work citing regular cycles in the average yearly price of pig iron — cycles that averaged nine years in length. Benner, who called himself "an Ohio farmer," published in 1875 a curiously interesting book called *Benner's Prophecies of Future Ups and Downs of Prices,* which went through numerous editions. In addition to the 9-year cycle in pig iron prices, he cited cycles averaging 5½ years in corn prices, 11 years in cotton prices, and 18 years between financial panics. He noted that the variations from a standard 9-year pattern in iron prices tended to repeat themselves every third cycle. Time has proved him right to the extent that, if you had purchased and sold pig iron on the basis of his projected 9-year patterns, your gains over a 69-year period would have been twelve times your loss.

There is also clear evidence of the continued existence of the 5½-year rhythm he discovered in corn prices. On the other hand, the 11-year rhythm he found in cotton prices has failed to continue to dominate. His observations as to the existence of an 18-year rhythm — with variations of not more than two years in either direction — fit very well with the facts about the 18⅓-year rhythm we shall discuss in Chapter IX; and the panics of 1893, 1907, and 1929 were all within two years — one way or another — of a rigid 18-year pattern based on 1873.

[*] Over the period for which we have data 9⅕ years fits stock-market behavior better than a rhythm of exactly 9 years in length. Over the same period, 9⅕ years better fits the swings in wholesale prices, too; but over the longer period for which wholesale price data are available, the length is seen to be more nearly 9 years. See Fig. 5.

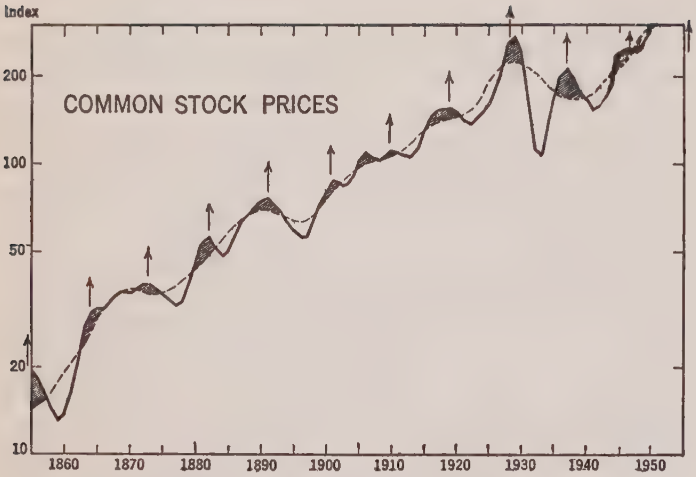


Fig. 2. U. S. Common Stock Prices

Axe-Houghton Index. 1854–1952 smoothed by means of a 3-year moving average, together with a weighted 9-year moving average, extrapolated. Shaded areas show time and extent of relative strength. Arrows mark highs of regular 9⅛-year cycles. (See footnote on page 88.)

covery began from the 1928 fall in commodity prices and from the subsequent 1929 crash in stock prices. The well-known peak in 1937 followed. The next peak of the ideal 9-year wave was in mid-1946.

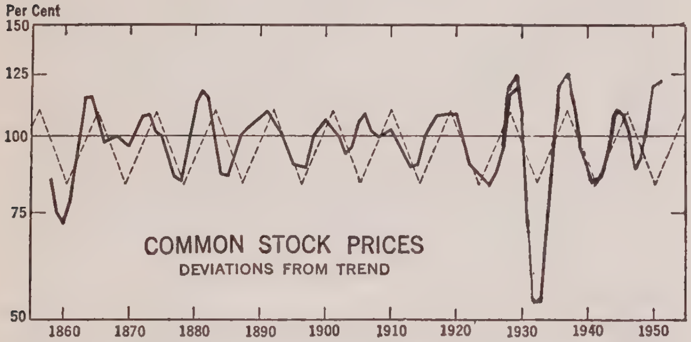


Fig. 3. The 9-Year Rhythm in Common Stock Prices

Percentage deviation of the 3-year moving average shown in Fig. 2 from the 9-year moving average also given in the same chart, together with a regular 9-year cycle.

A rhythm that has repeated itself as many times (10) and as regularly as this one cannot easily be the result of pure chance.

The regular cycle has been extended into the future to indicate approximately the behavior that may be expected in the deviations of the 3-year moving average from the 9-year moving average, if this rhythm continues.

THE HIGHS OF THE REGULAR CYCLE FALL AS FOLLOWS: 1856.5, 1865.5, 1874.5, 1883.5, 1892.5, 1901.5, 1910.5, 1919.5, 1928.5, 1937.5, 1946.5, 1955.5, 1964.5, 1973.5, 1982.5, ETC. THE LOWS FALL HALFWAY BETWEEN THESE DATES. (THE DECIMAL INDICATES THE POSITION WITHIN THE YEAR. THUS "1928.5" MEANS JUNE 30, 1928, ETC.

Such "calling of the turns" may be traced to the action of this rhythm, time and again, for scores of years in American economic history. The signal is clearest, as a rule, when near-by turns come also in the other rhythms we are observing. The concurrent movement of two major rhythms may often suffice to indicate such a turn in the symbols graphed on our charts; concurrent movement of three major rhythms indicate it almost unerringly. As Schumpeter has said:

> It is clear that the coincidence at any time of corresponding phases of all three cycles will always produce phenomena of unusual intensity, especially if the phases that coincide are those of prosperity or depression. The three deepest and longest "depressions" within the epoch covered by our material — 1825–1830, 1873–1878, and 1929–1934 — all display that characteristic.*

And further, regarding attempts to look back while the record is still fresh, and find the "causes" of the 1929 collapse:

> As a man may suffer from many ills and yet for an indefinite time lead a vigorous life without being inconvenienced by them until, when his general vitality has ebbed away, those ills or any one of them may suddenly acquire what to the specialist's eye will seem paramount or even of fatal importance; so the economic organism always does bleed from many wounds which it bears lightly in three out of the four cyclical phases, and which spell discomfort when one cycle, distress when two, catastrophe when all the cycles are in the depression phase.
>
> No doubt, external injuries were of unusually great importance in this case, *but explanation cannot be derived from them.* . . . The crisis was nowhere else anything like so severe as in the United States, the country most nearly free from injury by external factors †

This rhythm of 9 years, which is of such importance in our economic statistics, is like every other rhythm we discuss here — it is the registering of *a wave of activity in the economic organism.*

If, when we see the wave rising, we think only of statistics rising, we have a too limited view. For the statistics, of course, are only a reflection of human movement; they are merely *one* way of seeing it, and of measuring it. Schumpeter has shown, for instance, that what this 9-year wave really reflects is this: Repeatedly — at something like the 9-year interval — the industries creating the great economic thrusts-forward in the 54-year cycle have new surges of activity. There are new bursts of enthusiasm, of energy, of speculation, of production, of progress. The rise of this rhythm registers this almost unerringly. It is not surprising that the rise in such activity is accompanied by a rise or a "recovery" in wholesale prices.

If the reader will glance again at the chart for wholesale prices in the previous chapter, on page 70, he will be better prepared to look at Fig. 4, which is the latter part of this same chart with a 9-year moving average trend added. Figure 5 shows the deviations from trend charted with an ideal 9-year pattern. It is clear at first glance that they fit with astonishing regularity. The 9-year wave here is extremely evident. It shows up strikingly in many individual businesses (see Fig. 6) as well as in wholesale prices and prices of common stocks. (See Fig. 7 for a summary of the wave.)

Now we are ready for another step: in Fig. 8 see the experiment

---

* *Business Cycles*, p. 173.

† *Ibid.*, p. 911. Italics supplied.

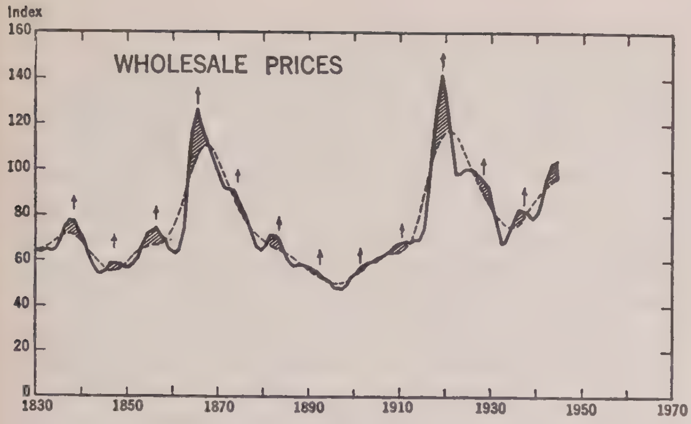


Fig. 4. U. S. Wholesale Prices, 1830–1945

(1926 = 100. A 3-year moving average, together with a weighted 9-year moving average, extrapolated to 1944.) Shaded areas show time and extent of relative strength. Arrows mark highs of regular 9-year cycles.

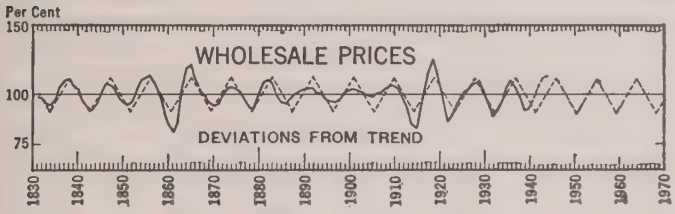


Fig. 5. The 9-Year Rhythm in Wholesale Prices

Percentage deviations of the 3-year moving average from the 9-year moving average, 1830–1944, together with a regular 9-year cycle.

A regular 9-year cycle has been added and projected into the future to show what will happen if this rhythm continues.

The dates of the turning points of the regular cycle are the same as those given for the regular cycle of common stocks in Fig. 3.

of creating a composite pattern by combining the 54-year pattern, which we examined in the previous chapter, with a pattern showing 9-year peaks. Against this "ideal" pattern, in Fig. 9, is now imposed a graph of American wholesale prices, smoothed by a 3-year moving average, as we first saw it on page 70. This time the peaks are not eliminated, as on page 71, when the graph was first applied to a simple 54-year pattern. Here the wartime peaks are allowed to remain. And what do we find?

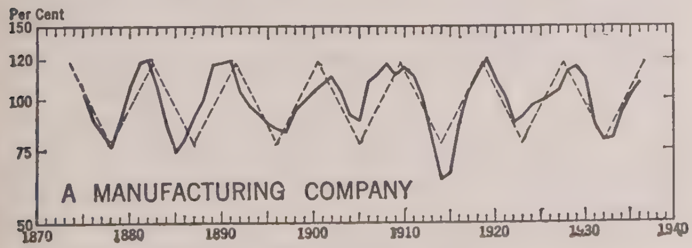


Fig. 6. An Individual Business

The 9-year rhythm in the sales of company A. Percentage deviations of the 3-year moving average from the 9-year moving average. A regular 9-year cycle has been added.

Strikingly enough, we find that the peaks in the actual record fit over the peaks of the ideal pattern laid out, with a most dramatic correspondence in timing. In particular, we see that two great wartime price peaks, occurring near the crest of each of the 54-year price rhythms, came at the top of the 9-year wave which rides the longer rhythm. Further, it was a 9-year peak occurring on the *up*-side of the 54-year wave. The combination of three forces — the upsweep in the 54-year wave, the upsweep in the 9-year wave, and the incalculable force of war — provided together a leverage of great intensity. The height of the two great inflation peaks here reflects that.

Now compare these two price peaks, as shown on the chart, with the third and smaller peak toward which our price line was reaching in 1945. From 1939 on into 1945 there was also a war to act as an inflationary force on the price level. But — in this 1939–1945 period, the 54-year wave was declining. Would the reader have said in advance that prices during World War II would rise as high as in World War I — knowing that the 54-year rhythm was no longer moving up, and that only the rising 9-year wave was there, working in conjunction with wartime forces, to hold up prices?

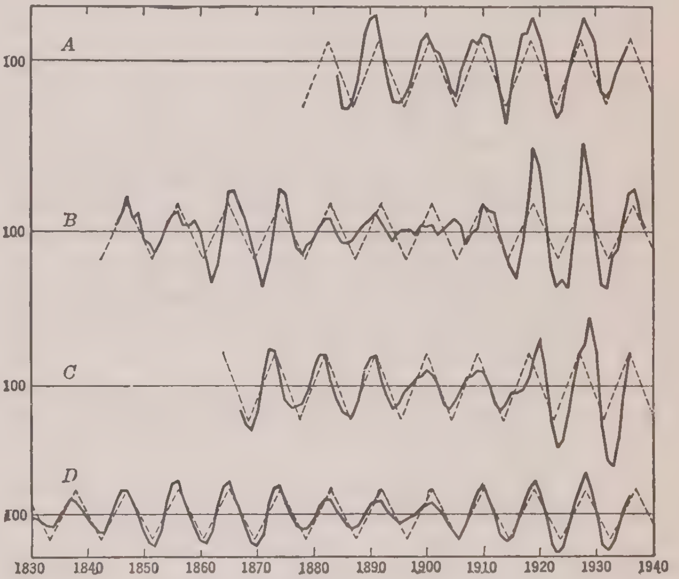


Fig. 7. Recapitulation, the 9-Year Rhythm

Percentage deviations of the 3-year moving averages from the 9-year moving averages in (A) Sales of Company A; (B) Sales of Company B (another company in a totally different industry); (C) Prices of Common Stocks; and (D) Wholesale Prices.

Regular 9-year cycles have been added to all curves. The first, third, and fourth have been smoothed by a 3 nine-year-section moving average.

On the basis of these patterns, he could have guessed, when the war commenced — and before he knew anything about the government price controls that would be imposed — that wholesale price levels during World War II would probably *not* reach the levels attained during or shortly after World War I. Nor did they. Not in England, or the United States, or Canada, or Australia, or New Zealand, or numerous other countries.

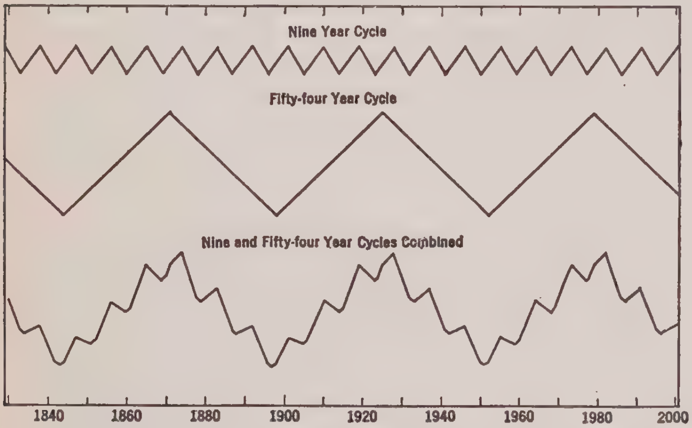


FIG. 8. SYNTHESIS

A 9-year cycle, a 54-year cycle, and the two combined. (See also Figs. 16, 17 and 18 on pages 65 and 66 in Chapter 5.)

The real price inflation that occurred in connection with World War I reached its maximum not with the end of the war, but about a year and a half later. There have been indications in the rhythms of the American economy that prices might similarly mount for a year or so following World War II — say, into 1947. But whether all average wholesale prices would reach the high levels of 1919 and 1920, before recession, could be doubted by those aware of the timing of the 54-year and 9-year cycles.

The man in the street could have told you that government "control" was the "reason" why World War II prices stayed below World War I levels. But our charts are not concerned with "reasons why" — they reflect rhythms.

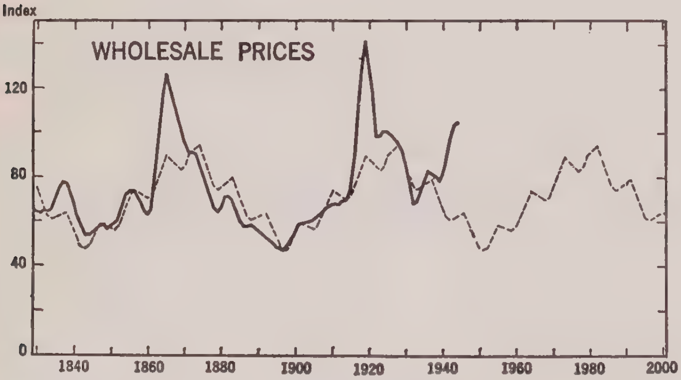


FIG. 9. U. S. WHOLESALE PRICES

Three-year moving average, 1926 = 100, together with the 9-year and 54-year cycles in combination (see Fig. 7 above). The projection should be thought of in terms of gold, 1937. It shows approximately what will happen (of course barring war distortions) if these two rhythms continue.

Look at the chart again, *circa* 1933. Do you see the 9-year wave rising there? That is the year in which American commodity prices started to rise again from depression bottoms of the 1930's. It is also the year in which the United States abandoned the gold standard. Many reasons have been cited for the economic upturn which began at that time. But if we record the facts only as seen in our rhythms, we may note that when the long-prevailing 9-year rhythm signaled for a rise, the rise came. After the country went off gold, prices in terms of gold still kept on going down. But prices in terms of the dollar — "real" prices so far as the American public was concerned — now went up, just as a projection of the 9-year rhythm could have forecast (see Fig. 10, borrowed from Warren and Pearson).

It has of course been argued that the rise in prices was "caused" by the departure from gold; and in so far as our price level is influenced by the price of *imported* commodities, that thesis is defensible. But whether departure from the gold standard then acted causally for the whole subsequent uptrend in prices is exceedingly problematical.

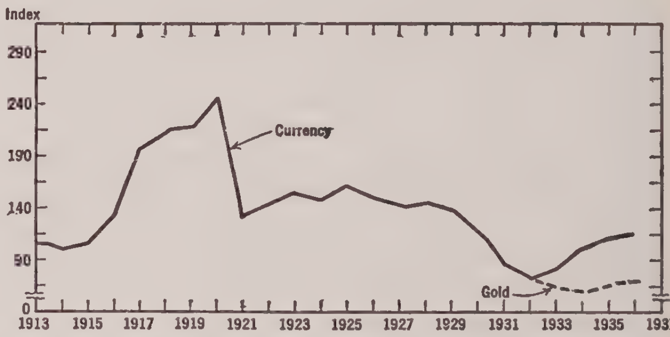


FIG. 10. GOLD PRICES AND CURRENCY

Prices of forty basic commodities in the United States in currency and in gold, 1913–1936 (after Warren and Pearson). 1910–1914 = 100.

This rise of prices from 1933 on, in harmony with the indicated 9-year pattern (the rise can possibly be dated from an earlier turn in 1932), was doubtless the event that inspired Professor Schumpeter's observation that a process running its course since at least the sixteenth century could hardly have come to a stop on March 4, 1933.

If this veers on a determinism disturbing to some readers, it is worth recalling — parenthetically — that all of us are born into a highly determined form of society in which everyone adjusts himself constantly to prevailing social patterns or goes down trying. (The greatest ability is adaptability, as Samuel Crothers once said.) Further, it is clear that there is room in these charts for all the freedom and accident of choice any reader would like to have implied. Consider, for instance, the wartime peaks in commodity prices. So far as our pattern is concerned, there is nothing there that calls for a *war*time peak at any time, or anywhere. Nor is there anything that tells us if and when war will break out. Nor, when it breaks, have we any way of measuring in advance the intensity of the leverage which this force will exert on the price level, once the force has been introduced into the pattern.

Davis, by measuring the intensity of war's effect on commodity prices, has worked out an interesting equation for comparing such a skirmish as our Spanish-American War with our effort in World War I. By comparison with 1917–1918, the affair of 1898 was no war at all.* But these are matters which may be seen only after the event, by noting the deviations of actual commodity prices from levels called for by long-term patterns. As previously noted, we have no way of knowing in advance when war is going to break. And we can only reason by analogy in judging what final effect a war might have.

There is nothing in the first two 54-year rhythms in our nation's history, for instance, to suggest that the third one would see two wartime peaks in commodity price levels. There does not seem to have been any pattern demanding even one war inflation. If our peak of 1919 did have two earlier precedents in the peaks of 1814 and 1865, occurring at nearly corresponding points on the cycle, there appears nothing to suggest that a wartime peak was bound to come then. All one could have done in 1914, when world war did break, was to have reasoned by analogy to the conclusion that world war at that point of the cycle, where two major rhythms were moving up together, would result in a very large leverage on prices. It did.

Quite similarly, and again only by analogy, it was possible to reason in 1939 that at this point of time — when the 54-year rhythm was moving downward — the advent of war would not have the price leverage of years such as 1914–1919, when war and two upsweeping cycles accompanied each other.

It would seem that such an interpretation, viewed from the vantage point of 1946, had justified itself. It must of course be stated flatly that analogy can always be dangerous. It must always be used warily, with full knowledge of the dangers.

Before we leave this subject of wartime commodity prices for a while, another warning, by way of qualification of the analysis, is worth registering. Please note, on Fig. 9, the last 9-year rhythm which starts rising on the declining 54-year rhythm in 1941 or 1942. This shorter rhythm, due to reach a peak in mid-1946, represented a strong rhythmic force. Though it was not reinforced by a rising 54-year cycle, to act in conjunction with it, it was given incalculable war leverage as a partner in its 1942–1946 rise. The combined result — as our 9-year rhythm reached for its peak — was a very heady inflation.

By analogy we could have reasoned in advance that the 1946 inflation would not reach 1919 heights, because of its position on the 54-year wave. But we had no ready way of estimating accurately *in advance* whether the inflationary leverage of World War II would be greater than in World War I, or by how much.

In the forties, of course, there were vastly greater quantities of money in circulation, stemming from wartime government deficits that far exceeded those connected with World War I. But statistical comparisons of this kind threw small advance light on comparable leverage, in view of such factors as the greater will-to-save on the part of the people, the tendency of many to hoard money and credits as a store of value, and the abolition of the free market effected under OPA and other government controls. Such variables made difficult any prediction based on estimates of the comparable war leverage factors during the two periods.*

But granting the hypothesis of much greater war leverage behind prices in the larger war of the forties, one could still ask in 1946 whether or not it would prove great enough to compensate for the lack of any price leverage in the declining 54-year rhythm. If so, then one might expect prices rising on the 9-year rhythm to reach a peak matching or exceeding that of 1919. If not, then the price level could still be expected to reach a substantial 1946–1947 peak, at the crest of the 9-year wave pattern — though probably well under the peak of 1919 when the 9-year and 54-year rhythms had both been rising in conjunction.

Our patterns could give us no definitive advance answer concerning the height of the peak to be reached. They could only indicate the approximate timing. But it seemed safe, even from the early vantage point of 1941, to assume that a very substantial 4- to 5-year rise in commodity prices and stock market levels lay ahead. The course of the 9-year rhythm made that forecast clearly possible. Those who made their plans accordingly, on the basis of the 9-year rhythm's projection, profited well.

---

* *Analysis of Economic Time Series*, p. 554.

* For further discussion of ways to measure the distortions of war, see Chapter XIV.

1954 POSTSCRIPT TO CHAPTER VII

We now know much more about the so-called nine-year cycle than was known ten years ago when Chapter VII was first written.

First, the 9-year cycle has come to light in a number of additional phenomena, social, economic, and natural.

Second, studies of figures prior to 1830 show that as we go backward in time, the 9-year cycle continues to be manifest. To find any cycle in an extension of the data is most gratifying, for it adds greatly to our basis of confidence in its significance.

Third, studies of this cycle in additional phenomena and more exact measurements show that the 9-year cycle has slightly different wave lengths in different series of figures. After all allowances for random distortions, it seems probable that we are observing the results of different rhythmic forces, each of them close to nine years in length. Some series of figures seem to be influenced by one of these forces, some by another, and some by combinations of such forces.

Additional Research

Let me first tell you of the additional phenomena now known to evidence "9-year" cycles.

Fig. 1 shows you a 9.20-year cycle in pig iron prices in the United States, from the earliest figures available, in 1784, up to the present time.[1] The 170 year period gives opportunity for more than 19 repetitions of the pattern. To ascribe a chance cause to behavior of this regularity, persistence, and dominance is fantastic.

Fig. 2 shows you a 9.28-year cycle in copper prices in the United States over the same length of time.[2] Here again we have marked regularity which cannot reasonably be attributed to chance.

Fig.3 shows you a 9.3-year cycle in physical production in

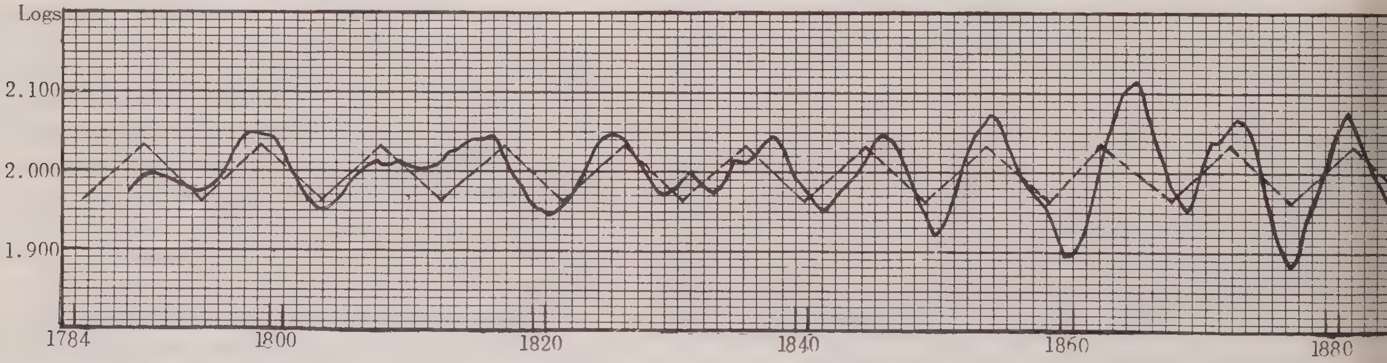


Fig. 1. The 9-Year Rhythm in Pig Iron Prices. Percentage deviations, 1789--1948

U. S. A., 1784—1953, toge

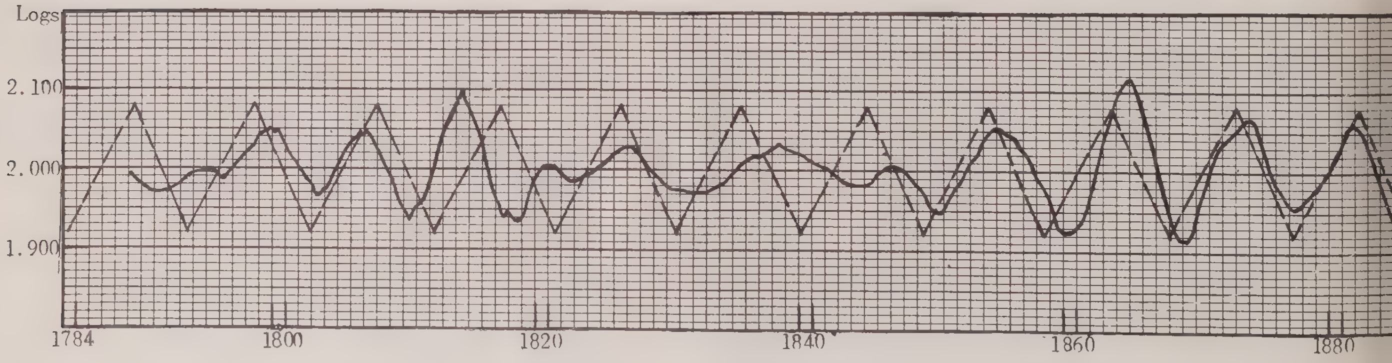


Fig. 2. The 9-Year Rhythm in Copper Prices. Percentage deviations of a 17 qua

1953, together wit

the United States, 1863 to date.[3] The ninety year period gives opportunity for but 10 repetitions of the cycle, but even 10 consecutive repetitions is too many to occur as a result of random forces.

In Fig. 4 you can see a 9.3-year cycle in the virulence of grasshopper outbreaks (i.e. in the abundance of grasshoppers) in the United States for the hundred years, 1841 through 1940.[4]

Fig. 5 shows you a 9-year cycle in new members taken into the Presbyterian Church in the United States for the 128 year period, 1826 to date.[5] Although it seems to have been fading out, a knowledge of this cycle enabled churchmen to forecast the peak in the figures which came in 1949 and to know in advance about the decline which followed.[6]

Fig. 6 gives you the same sort of information for new members of the Congregational Christian Church, 1857 to date.[7] As with new Presbyterian members, the length of the cycle seems to be exactly 9 years.

The dominant cycle in the abundance of the Canadian lynx is 9.6 years long and thus is totally unrelated to the 9.0- to 9.3-year cycles we are discussing here. However, it has been discovered that if you adjust the figures of lynx abundance for the typical 9.6-year cycle, an important 9.0-year cycle is discoverable in the remainder.[8]

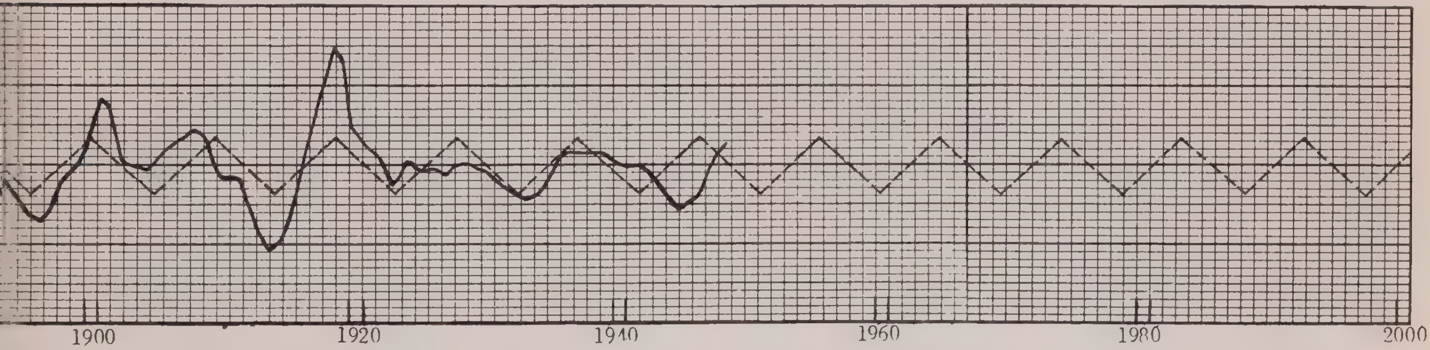
A "wonderful 8.85-year cycle" in the thickness and thinness of the rings in a preglacial tree has been observed.[9]

Cycles of 9.1- and 9.2-years have been discovered in the thickness and thinness of tree rings at Flagstaff, Arizona, and Santa Catalina, Arizona, respectively.[10]

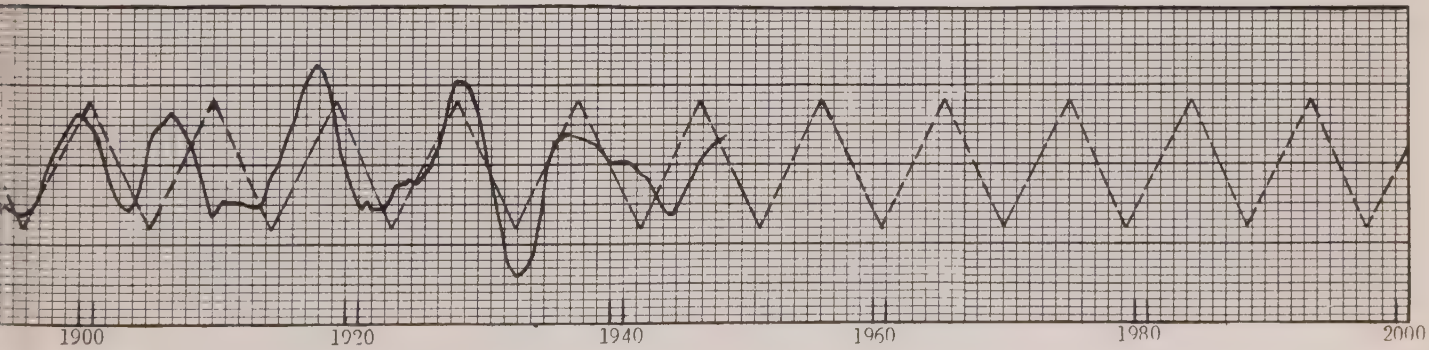
In Fig. 7 you can see the "9-year" cycle in wheat prices in the United States, crop years 1866-7—1951-2.[11] The typical length of this cycle is 9.3 years for the 90 years studied.

A supplemental study of wheat prices back to 1709 suggests that the 9.3-year cycle in wheat prices in the United States may be compound of two cycles—one slightly longer and one slightly shorter than 9.3 years, but the results of this study have not yet been published.

A multiple harmonic analysis of pig iron prices, 1784—1951, suggests 9.24 years as the most probable length of the "9-year" cycle in these figures.[12]



quarter moving average from a 41 quarter moving average of actual prices,
a regular 9.2-year cycle.



ng average from a 41 quarter moving average of actual prices, U. S. A., 1784—
lar 9.28-year cycle.

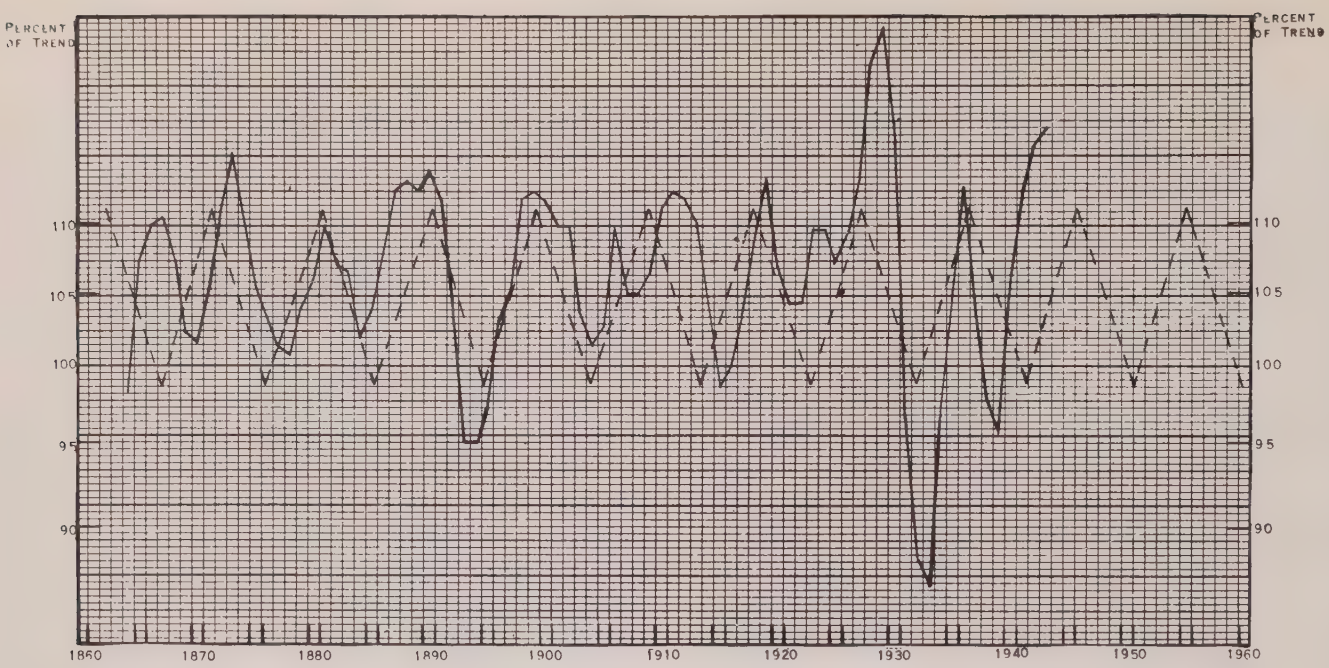


Fig. 3. The 9.3-Year Cycle in Manufacturing Production. Solid Line Shows Smoothed Deviations from the 11-Year Moving Average, Both Adjusted for the 11.2-Year Cycle and Wars. Broken Line is the Ideal 9.3-Year Cycle.

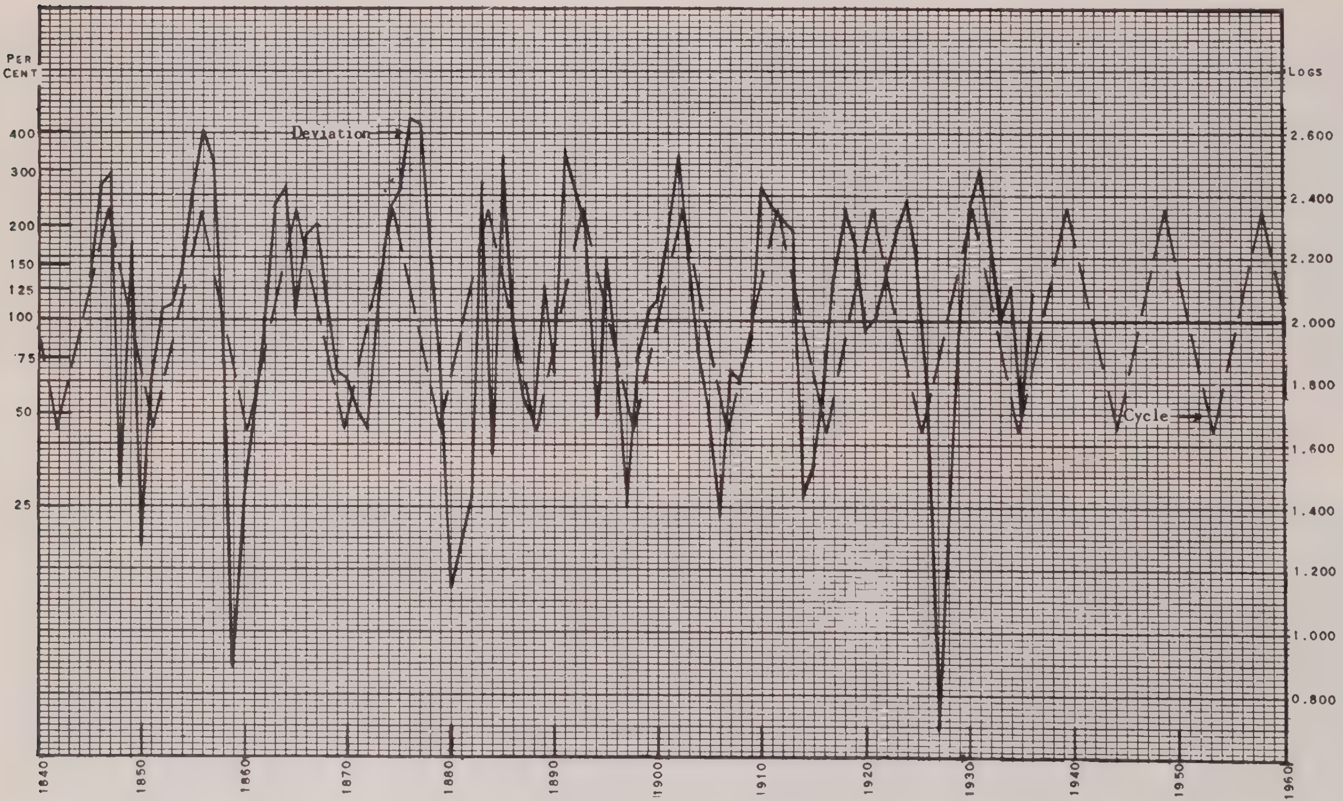


Fig. 4. Deviations of Index of Grasshopper Outbreaks, 1841-1940, from its 9-Year Moving Average and the Ideal 9.3-Year Cycle.

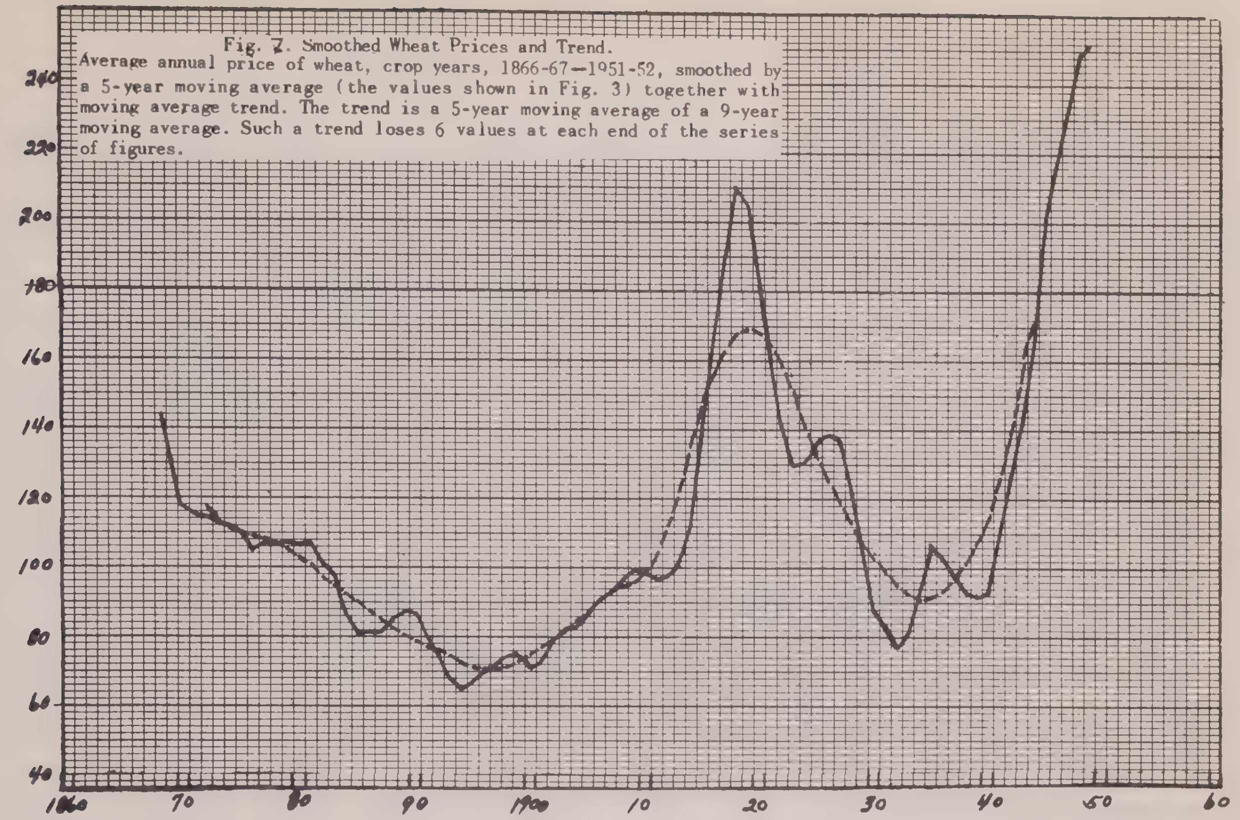
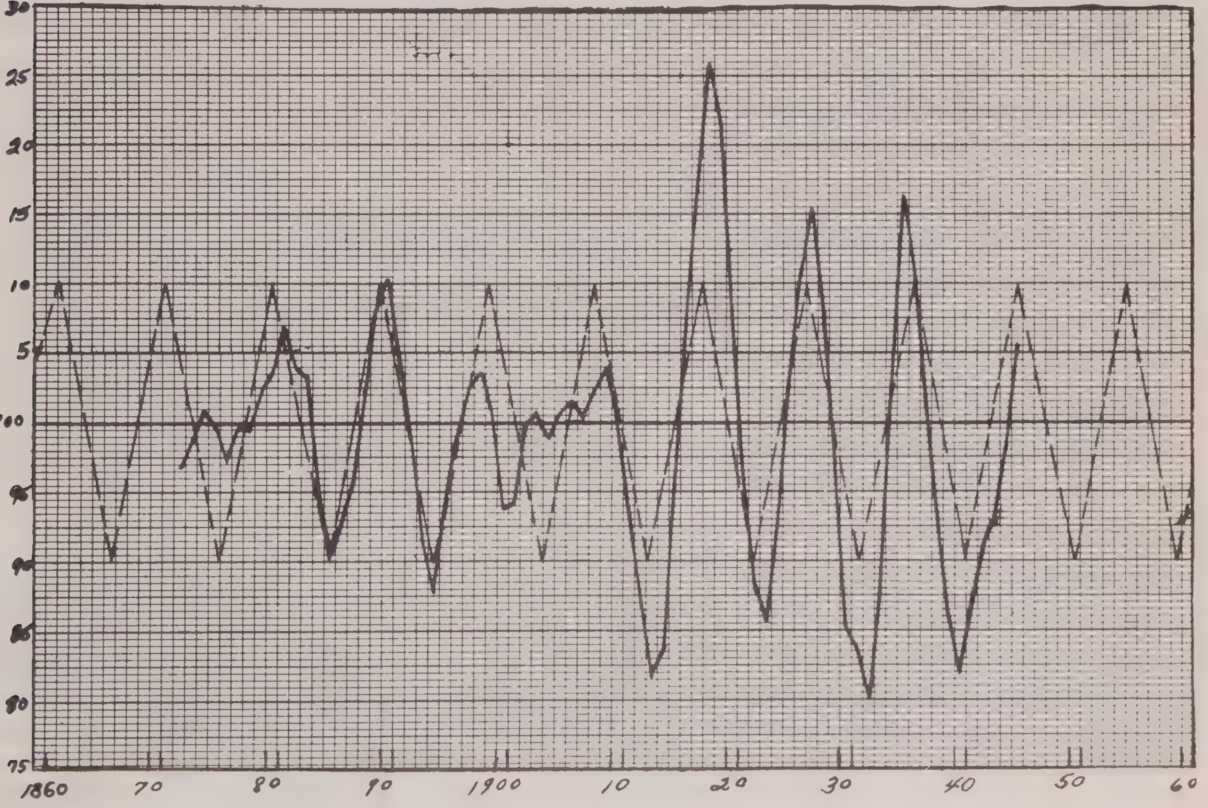


Fig. 7. Smoothed Wheat Prices and Trend.
Average annual price of wheat, crop years, 1866-67—1951-52, smoothed by a 5-year moving average (the values shown in Fig. 3) together with moving average trend. The trend is a 5-year moving average of a 9-year moving average. Such a trend loses 6 values at each end of the series of figures.



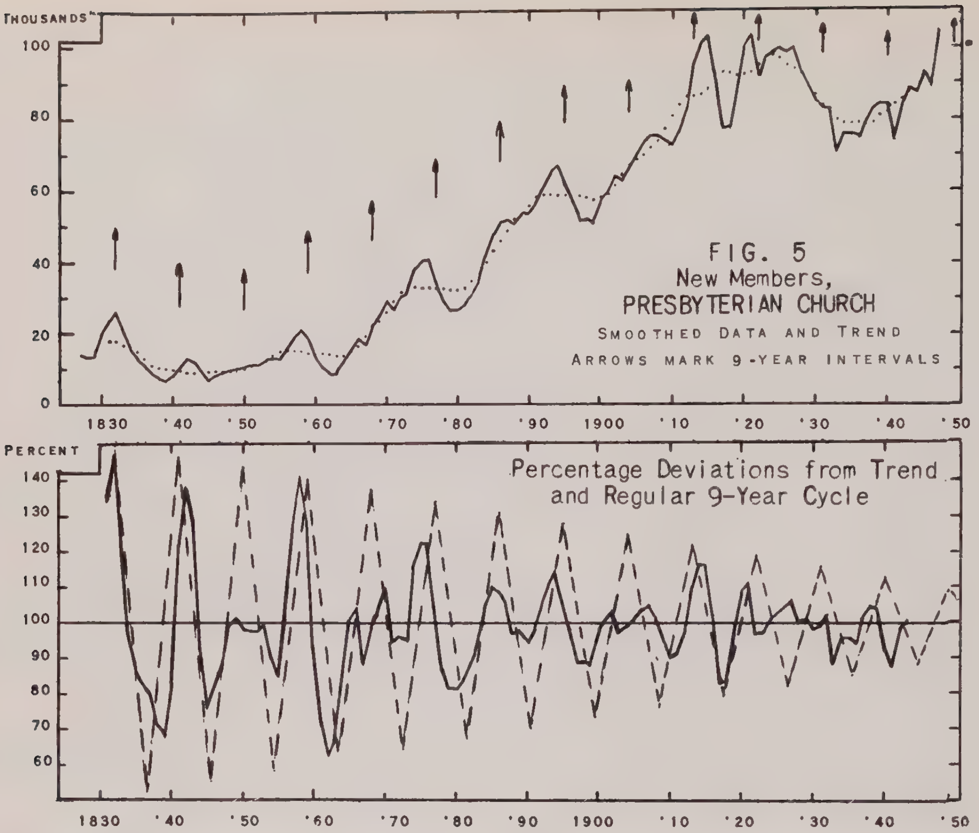


FIG. 5
New Members,
PRESBYTERIAN CHURCH
Smoothed Data and Trend
Arrows mark 9-year intervals

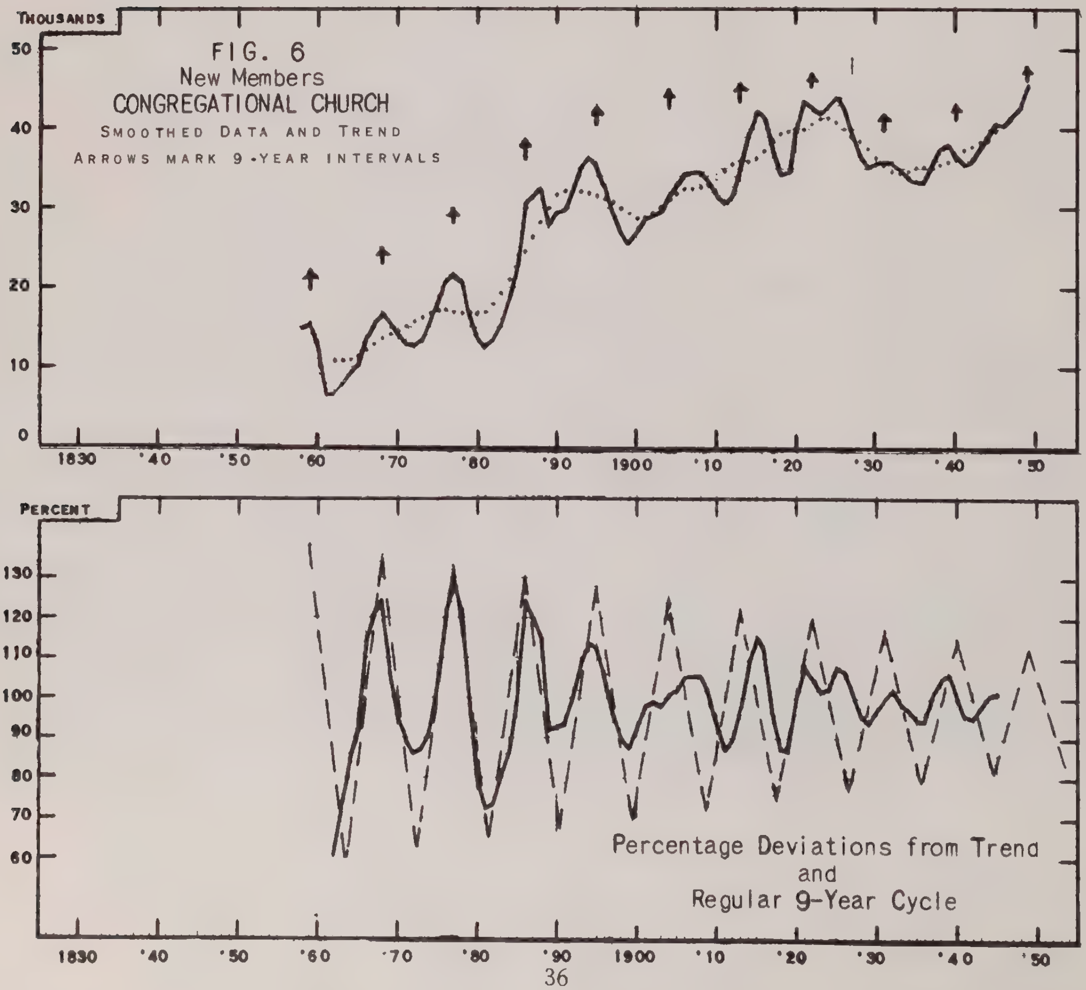


FIG. 6
New Members
CONGREGATIONAL CHURCH
Smoothed Data and Trend
Arrows mark 9-year intervals

The liabilities of commercial and industrial failures in the United States, 1851-1953, show a 9.2-year cycle.[13] See Fig. 8.

A multiple harmonic analysis of industrial common stock prices, 1871-1950, suggest 9.3 years as the probable length of this cycle,[14] but analysis by other methods suggest 9.2 years as more likely.[15, 16] See Fig. 9.

A multiple harmonic analysis of railroad stock prices, 1831-1950, suggests 9.28 years as the probable length.[17]

A multiple harmonic analysis of cotton prices, 1731-2--1940-1, suggests cycles about 8.9, 9.1, 9.3, and 9.6 years in length.[18]

Rhythmically recurring tidal cycles that fall every 9 years have been reported.[19]

Where does this leave us?

Cotton prices, covering the longest period of time, probably come closest to giving us the true answer. I suspect cycles about 8.9, 9.1, 9.3, and 9.6 years in length. The 8.9- and the 9.1-year cycles could combine to produce an intermediate cycle about 9 years long. The 9.1- and 9.3-year cycles could combine to produce cycles 9.2 years long, more or less, according to the relative strength of the two components.

To test this hypothesis and to obtain the exact length of the various cycles we would need a series of figures at least 650 years—preferably 850 years—long. We have such series of figures available, but, so far, I have lacked the time to make the investigation.

The 9-Year Cycle Merely a Tendency

As with the 54-year cycle discussed in Chapter VI, the 9-year cycle is merely a *tendency*. The charts show this fact clearly. However, once they learn of a cycle, people seem to assume that the cycle should thereafter prevail absolutely and with perfect regularity, even though the record shows that the cycle has always been irregular in the past, crests and troughs coming sometimes early, sometimes late. Seemingly, in the text, Mr. Dakin and I did not sufficiently emphasize the inevitable irregularity. Other cycles and random forces are *always* present. Any given cycle can *never* be expected to come exactly on time, except as a matter of luck. To know whether, in any particular instance, a crest or a trough will probably come early or late you must know about the other cycles present too. But even if you know about *all* the cycles there is still the inevitability of random forces which will create still further distortion. In forecasting, we are never going to be able to do away with brains.

The two chief exhibits of Chapter VII, as originally printed, concern the 9-year cycle in common stock prices and in average wholesale prices.

I have brought the stock market charts up to date by additions to the original charts, but the complications created by our abandonment of the gold standard and our resort to printing press money make it necessary to bring the wholesale price charts up to date separately.

As implied by the text, the matter of gold is not as im-

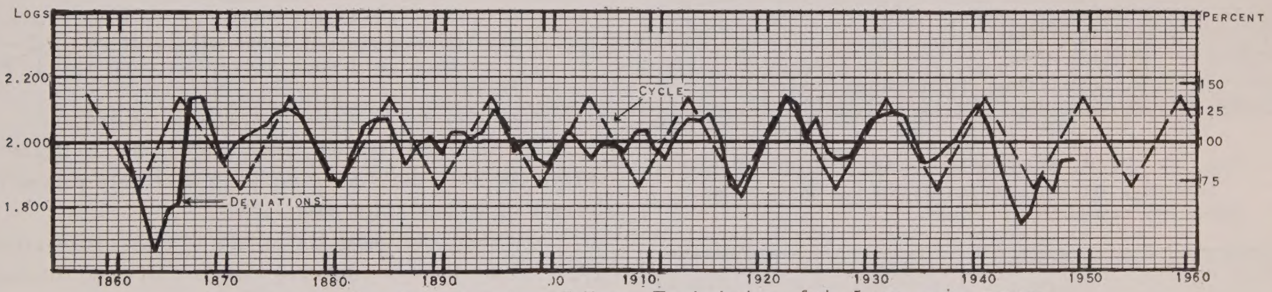


Fig. 8. The 9.2-Year Cycle in Business Failures. The deviations of the 5-year moving average from the 9-year moving average and the ideal 9.2-year cycle.

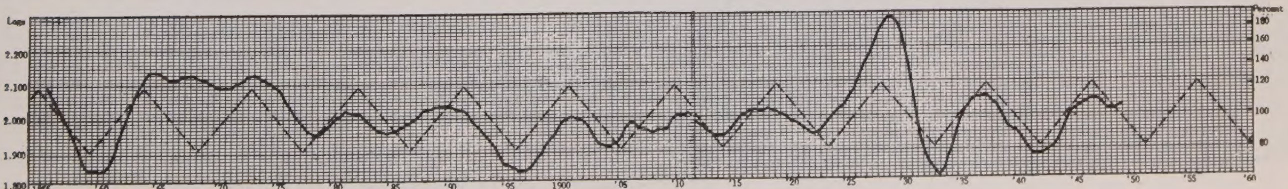


Fig. 9. The 9-Year Rhythm in Common Stock Prices.
A supplemental study using Clement Burgess' index 1854—1870, and Standard and Poor's Corporation Industrial Stock Price index 1871—1950 expressed as deviations from a straight line trend.
The index values have been smoothed by a moving average. A 9-year cycle has been added. Ratio Scale.

portant in a relatively short cycle such as the 9-year cycle as it is with a long cycle like the one of 54 years. A short cycle oscillates around a relatively long term factor such as inflation, whereas, a 20-year distortion (1932 to date) is only a short term movement relative to a 54-year cycle. As such, it distorts it badly.

The inflation situation is complicated by the fact that no one knows for sure just how to adjust for the distortion caused by this political action. The method I have used is to convert to a gold basis according to the black market currency price of double gold eagles; but this method, like all others, is subject to criticism.

Figs. 10 and 11 below show the latter part of Fig. 4 and Fig. 5 on page 93 of Chapter VII, brought up to date.

Figs. 12 and 13 show the same values adjusted to a gold basis, in accordance with the method described above.

By comparing Fig. 11 and Fig. 13 it is easy to see that for a short cycle such as this one of 9 years it makes very little difference whether we adjust for gold or do not.

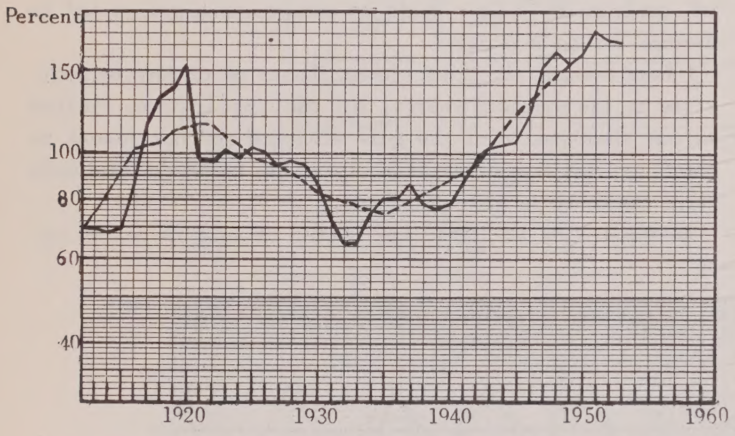


Fig. 10. U. S. Wholesale Prices, 1912—1953.
A 9-year moving average trend has been added.
Index 1926 = 100. Ratio Scale.

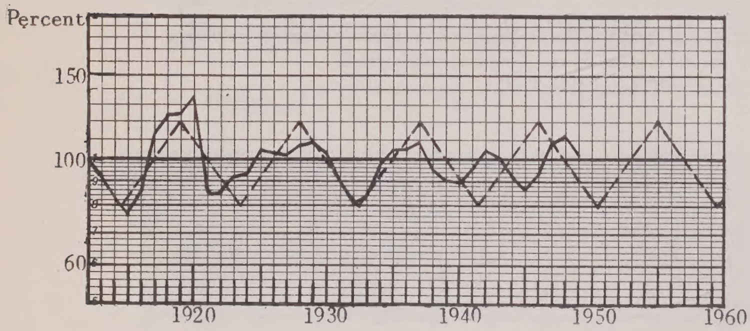


Fig. 11. The 9-Year Rhythm in Wholesale Prices.
Percentage deviations, 1912—1949, from a 9-year moving average trend of the index 1912—1953.
A regular 9-year cycle has been added. Ratio Scale.

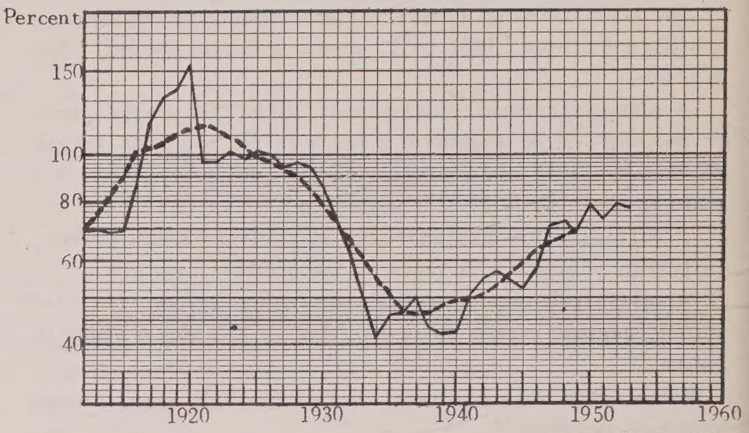


Fig. 12. U. S. Wholesale Prices, 1912—1953, in Gold.
A 9-year moving average trend has been added.
Index 1926 = 100. Ratio Scale.

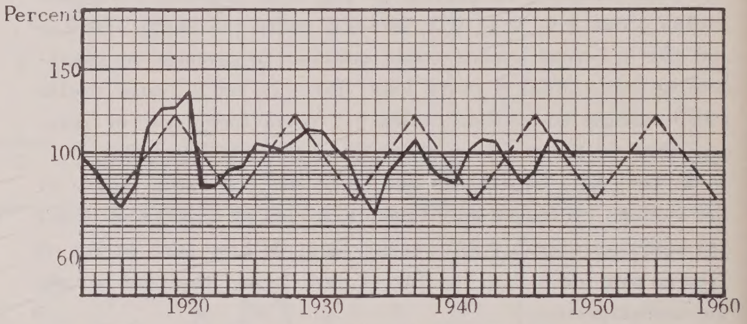


Fig. 13. The 9-Year Rhythm in Wholesale Prices, in Gold.
Percentage deviations, 1912—1949, from a 9-year moving average trend of the index 1912—1953.
A regular 9-year cycle has been added. Ratio Scale.

It is also easy to see that, partly due to price control during the war, the 9-year cycle in wholesale prices has been largely wiped out since about 1939.

I say that the weakness of the 9-year cycle since about 1937 is due *partly* to price control distortion because I suspect another factor as well. Research in respect to the so-called 9-year cycle in pig iron prices and copper prices since 1784 (to be reported upon shortly in *Cycles—A Monthly Report*) shows a concurrent cycle of about 8.5 years long in each of the series which, at the present time, is offsetting and weakening the 9.2-year cycle, and which is due to do so for several cycles to come. In projecting the 9.2-year cycle in wholesale prices or any other series of figures this concurrent cycle whould be investigated and, if present, should be taken into account in the projection.

This is as good a place as any to remind you once again that the cycles in each series of figures must be separately determined.

Summary

It seems to me that the research which has been conducted during the past ten years demonstrates conclusively the widespread presence of rhythmic cycles of about 9 years in length in many natural and social phenomena.

On the other hand, this additional research likewise demonstrates that the problem is not as simple as it looks on the surface. The so-called 9-year cycle which is manifest in so many series of figures seems to be a complex of several cycles closely related in length, which sometimes enhance each other and sometimes offset each other. A significant start has been made in the determination of the various constituents, but much more remains to be done.

E.R.D.

References

1. An unpublished report on pig iron price cycles in the files of the Foundation for the Study of Cycles.
2. An unpublished report on copper price cycles in the files of the Foundation for the Study of Cycles.
3. *Cycles—A Monthly Report*, Vol. 4, No. 10, December 1953, p. 331.
4. *Cycles—A Monthly Report*, Vol. 4, No. 6, June 1953, pp. 176-7.
5. *Cycles—A Monthly Report*, Vol. 1, No. 1, June 1950, pp. 3-8.
6. *Cycles—A Monthly Report*, Vol. 4, No. 5, May 1953, p. 150.
7. *Cycles—A Monthly Report*, Vol. 2, No. 5, May 1951, pp. 163-5.
8. Wing, Leonard W., "Cycles of Lynx Abundance," *Journal of Cycle Research*, Vol. 2, No. 2, Spring 1953, pp. 28-52.
9. *Cycles—A Monthly Report*, Vol. 2, No. 2, February 1951, p. 48.
10. Douglass, A. E., as reported in manuscript by W. E. Gladwin in the files of the Foundation for the Study of Cycles.
11. *Cycles—A Monthly Report*, Vol. 4, No. 5, May 1953, pp. 139-41.
12. *Cycles—A Monthly Report*, Vol. 3, No. 4, June 1952, pp. 207-09.
13. *Cycles—A Monthly Report*, Vol. 4, No. 8, October 1953, pp. 260-61.
14. *Cycles—A Monthly Report*, Vol. 3, No. 5, May 1952, pp. 166-79.
15. *Cycles—A Monthly Report*, Vol. 2, No. 6, June 1951, pp. 204-07.
16. Hughey, Vedder, "Cyclic Analysis, Industrial Common Stock Index, 1854-1951," in *Cycles—A Monthly Report*, Vol. 4 No. 3, March 1953, pp. 123-30.
17. *Cycles—A Monthly Report*, Vol. 3, No. 4, April 1952, pp. 123-29.
18. Unpublished manuscript in the files of the Foundation for the Study of Cycles.
19. Carson, R. L., *The Sea Around Us*, p. 183.

Mr. H. A. Musham
741 No. Rush St.
Chicago, Ill.

Feb.
#3011

1954 SUMMER FELLOWSHIP

Through the generosity of the L. Peter Cogan Foundation, Inc., it is possible for the Foundation for the Study of Cycles to award a fellowship for the summer of 1954. The fellowship will enable a qualified person to study cycle analysis at Foundation research headquarters.

This fellowship will be awarded in the field of botony, zoology, medicine, economics, or sociology. The Foundation will accept applications for the fellowship from persons trained in any of the above fields *and* in statistics. The selected candidate will study at East Brady, Pennsylvania.

The Foundation will reimburse the approved candidate for his expenses to and from Foundation headquarters, his expenses while in residence, and will award such other sum as the candidate may need to enable him to take advantage of the offer.

A candidate for this fellowship should make application to the Director of the Foundation for the Study of Cycles at East Brady, Pennsylvania, stating his qualifications and the amount of money he will need. He should submit samples of work that he has already done in this field. Preference will be given to persons on the teaching staff of a senior college or university.